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(54) **INTEGRATED EDGE LIGHTING FOR GAMING DEVICE**

(71) Applicant: **Aristocrat Technologies, Inc.**, Las Vegas, NV (US)

(72) Inventors: **Samuel Villanueva**, Las Vegas, NV (US); **Garrett Hill**, Las Vegas, NV (US)

(73) Assignee: **Aristocrat Technologies, Inc.**, Las Vegas, NV (US)

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(58) **Field of Classification Search**

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See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,915,641 A 4/1990 Miskin  
5,653,638 A 8/1997 Nagata  
(Continued)

FOREIGN PATENT DOCUMENTS

CN 203219363 U 9/2013  
GB 2161969 B 3/1988  
(Continued)

OTHER PUBLICATIONS

Office Action dated Jul. 21, 2022 for U.S. Appl. No. 17/490,662 (pp. 1-21).

(Continued)

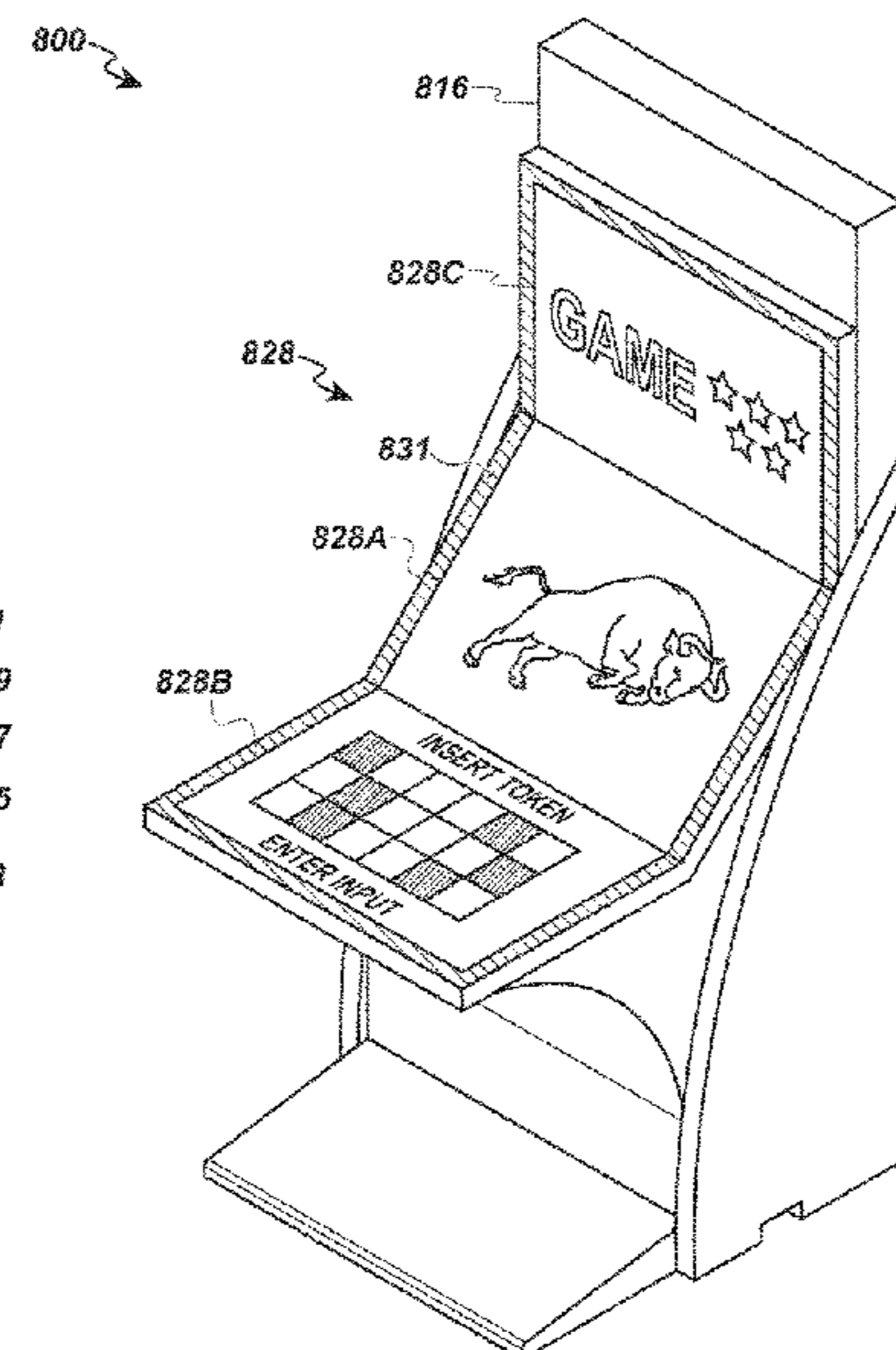
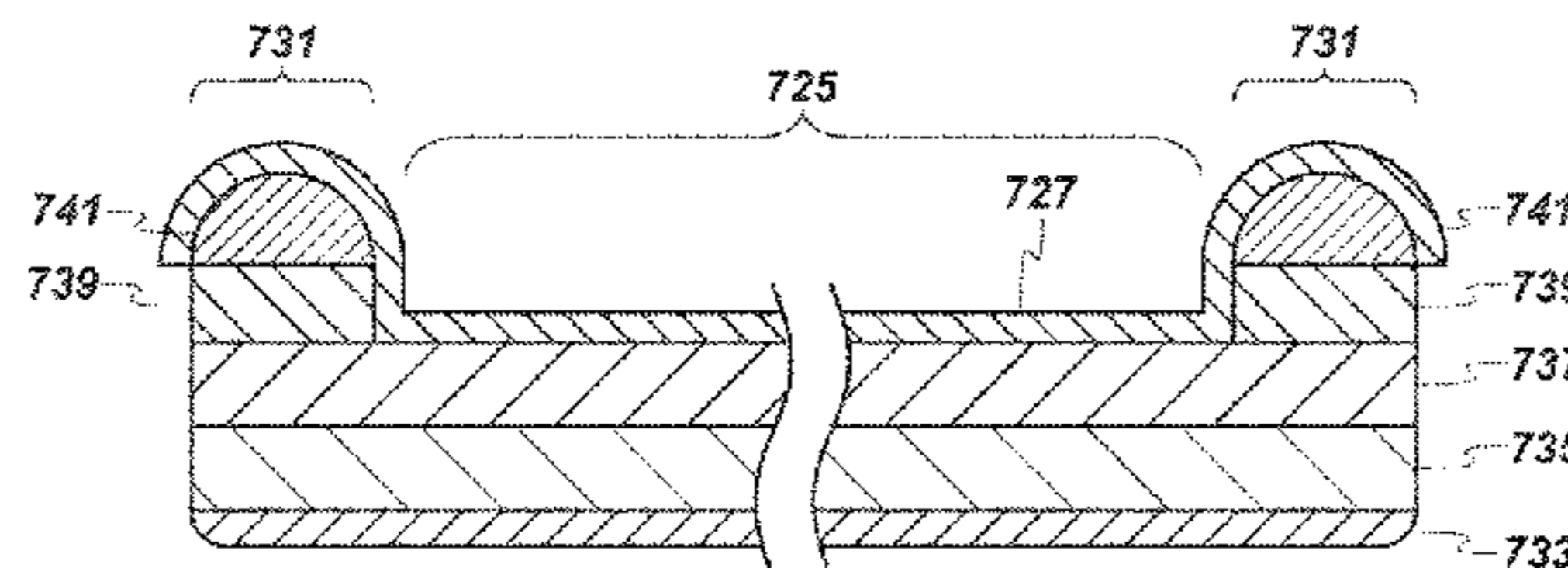
*Primary Examiner* — Robert T Clarke, Jr.

(74) *Attorney, Agent, or Firm* — Brownstein Hyatt Farber Schreck, LLP

(57) **ABSTRACT**

A gaming device may comprise various components, including a main cabinet, a game controller, and a display assembly. The display assembly may be releasably coupled to the game cabinet so that the display assembly may be quickly removed prior to replacement and/or maintenance operations. The display assembly may include a display panel and the display panel may be separated into multiple display regions. A perimeter of the display panel may be reserved for edge lighting purposes and may attract a user's attention to the gaming device.

**20 Claims, 15 Drawing Sheets**



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*H05K 5/03* (2006.01)  
*H05K 5/00* (2006.01)  
*G06F 3/041* (2006.01)

- (52) **U.S. Cl.**  
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 (2013.01); *G07F 17/3267* (2013.01)

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,940,153 A \* 8/1999 Castaneda ..... H04M 1/22  
 361/679.01  
 6,702,604 B1 3/2004 Moscovitch  
 7,742,289 B2 6/2010 Quijano  
 7,789,668 B1 9/2010 Hamner  
 7,933,117 B2 4/2011 Howarth  
 8,183,590 B2 5/2012 Suzuki  
 8,810,479 B2 8/2014 Kim  
 9,468,841 B2 10/2016 Stellenberg  
 9,880,729 B2 1/2018 Rakshit  
 9,945,509 B2 4/2018 Barnes  
 10,210,699 B2 2/2019 Thompson  
 10,476,181 B2 11/2019 Kaneko  
 10,569,718 B2 2/2020 Barnes  
 10,699,514 B2 6/2020 Lapalme  
 2004/0150581 A1 8/2004 Westerinen  
 2005/0215325 A1 9/2005 Binh  
 2006/0281558 A1 12/2006 Rifkin  
 2007/0280593 A1 12/2007 Brychell  
 2007/0287527 A1 12/2007 Tanabe  
 2007/0298880 A1 12/2007 Rasmussen  
 2008/0058051 A1 3/2008 Seelig  
 2008/0062625 A1 3/2008 Batio  
 2009/0275378 A1 11/2009 Anderson  
 2010/0173704 A1 7/2010 Cole  
 2010/0291992 A1 11/2010 Greenberg  
 2011/0057965 A1 3/2011 Park  
 2011/0070948 A1 3/2011 Bainbridge  
 2012/0037724 A1 2/2012 Prentice  
 2012/0050200 A1 3/2012 Vartanian  
 2012/0208645 A1 8/2012 Rodriguez

2012/0268691 A1 10/2012 Kuo  
 2012/0270648 A1 10/2012 Rasmussen  
 2012/0282997 A1 11/2012 Miner  
 2014/0232617 A1 8/2014 Anite  
 2016/0335835 A1 11/2016 Castro  
 2016/0335836 A1 11/2016 Castro  
 2017/0053478 A1 2/2017 Wudtke  
 2017/0132870 A1 \* 5/2017 Thompson ..... G07F 17/3211  
 2018/0101350 A1 4/2018 Nonaka  
 2018/0157115 A1 6/2018 Hineno  
 2019/0080554 A1 3/2019 Barbour  
 2019/0096170 A1 3/2019 Lewis  
 2019/0096174 A1 3/2019 Ambrecht  
 2019/0102969 A1 4/2019 Lapalme  
 2019/0102975 A1 \* 4/2019 Lapalme ..... G07F 17/3209  
 2019/0266835 A1 8/2019 Ambrecht  
 2020/0238170 A1 7/2020 Alsaid  
 2021/0019986 A1 \* 1/2021 Urban ..... F21V 3/049  
 2021/0090383 A1 3/2021 Rodriguez  
 2021/0205716 A1 7/2021 Shin  
 2021/0209893 A1 7/2021 Rye  
 2021/0322595 A1 10/2021 Colvin  
 2022/0092921 A1 3/2022 Barbour  
 2022/0180695 A1 6/2022 Fritz  
 2022/0301387 A1 9/2022 Villanueva  
 2022/0301391 A1 9/2022 Villanueva

FOREIGN PATENT DOCUMENTS

WO 2006015046 A3 5/2007  
 WO 2018057380 A1 3/2018

OTHER PUBLICATIONS

Office Action (Notice of Allowance and Fees Due (PTOL-85)) dated Mar. 13, 2023 for U.S. Appl. No. 17/490,662 (pp. 1-8).  
 Office Action (Final Rejection) dated Jan. 5, 2023 for U.S. Appl. No. 17/490,662 (pp. 1-24).  
 Office Action (Non-Final Rejection) dated Oct. 4, 2023 for U.S. Appl. No. 17/490,916 (pp. 1-9).  
 Office Action (Non-Final Rejection) dated Jun. 23, 2023 for U.S. Appl. No. 17/490,768 (pp. 1-8).  
 Office Action (Non-Final Rejection) dated Aug. 29, 2023 for U.S. Appl. No. 17/490,768 (pp. 1-10).

\* cited by examiner



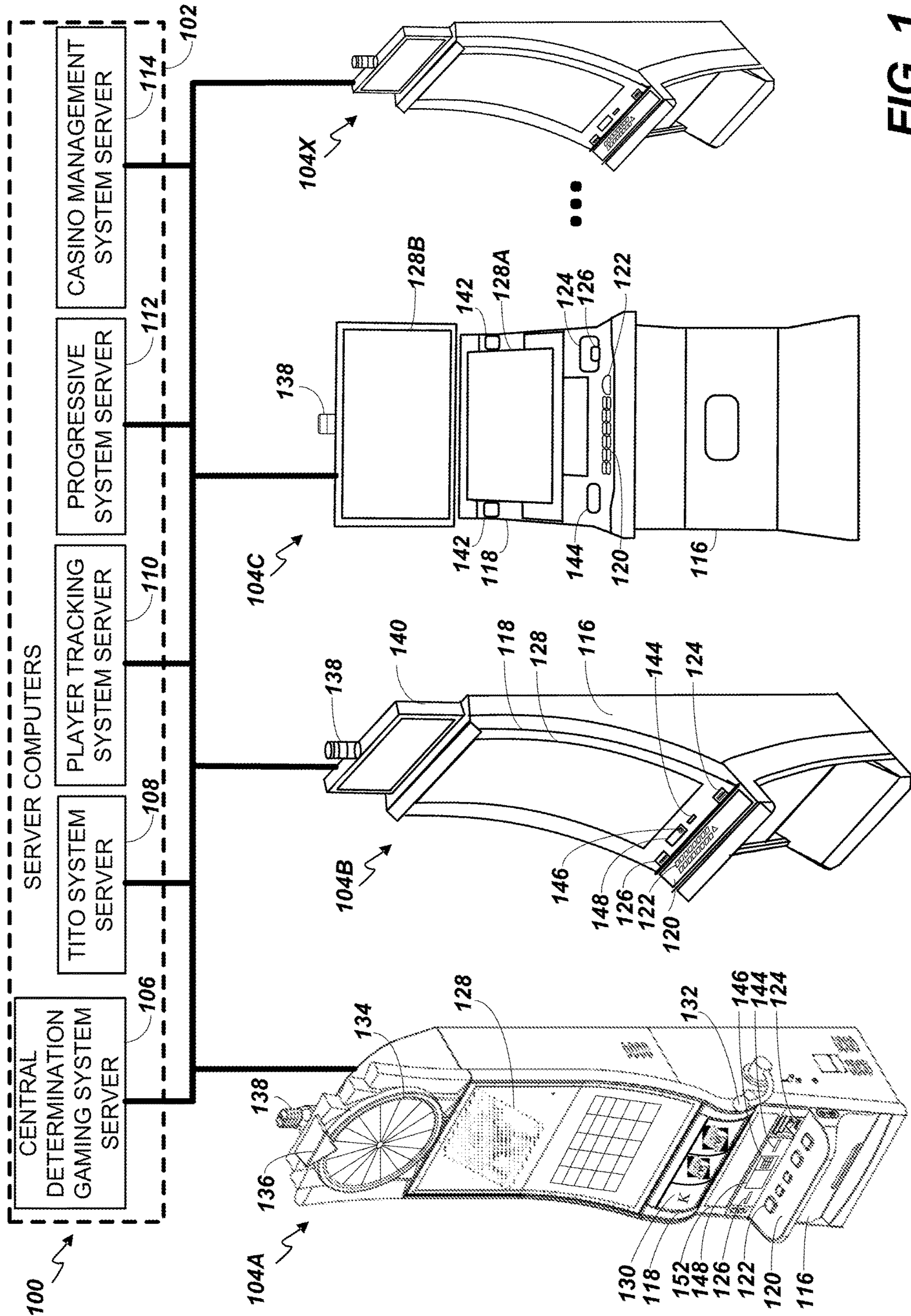


FIG. 1

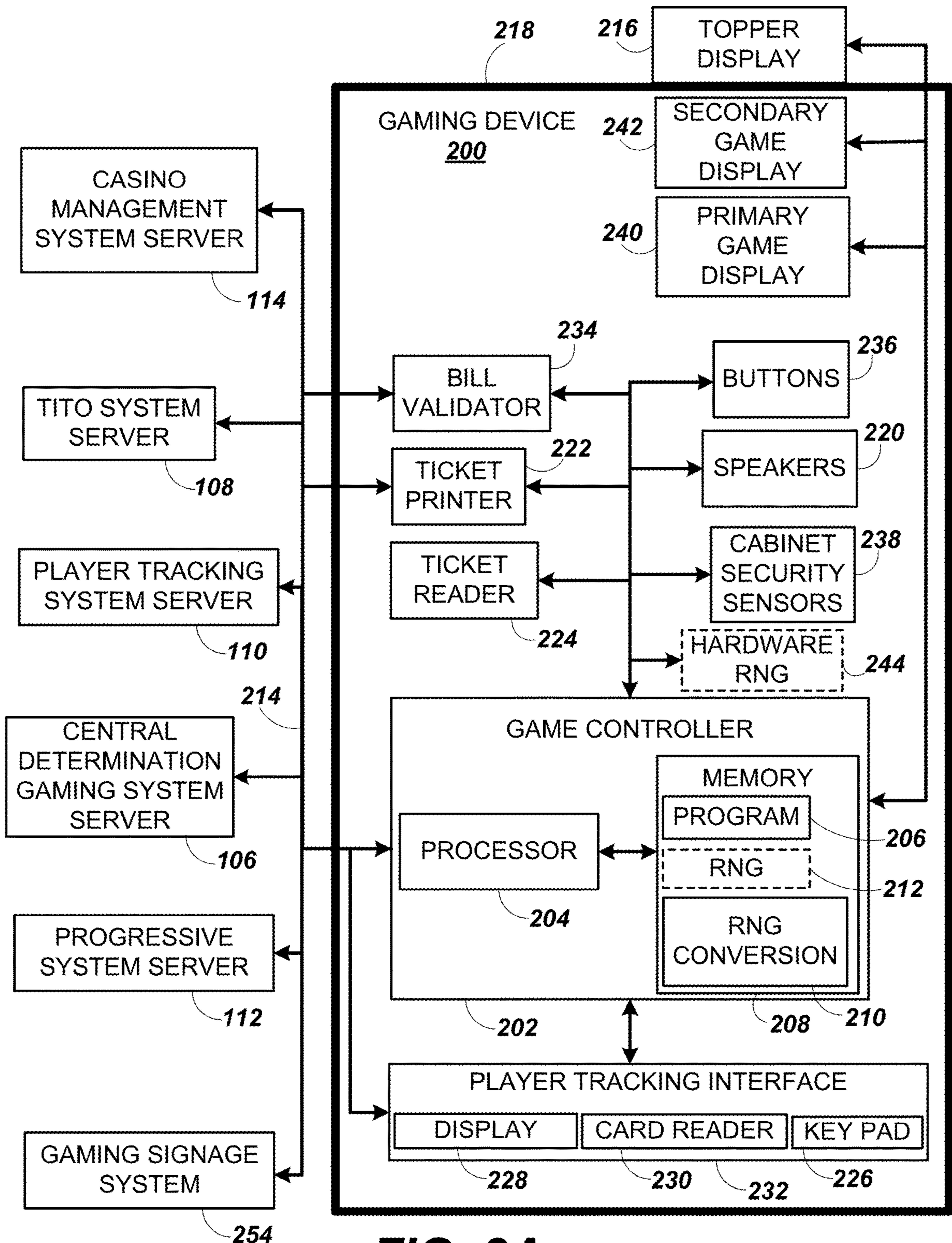


FIG. 2A



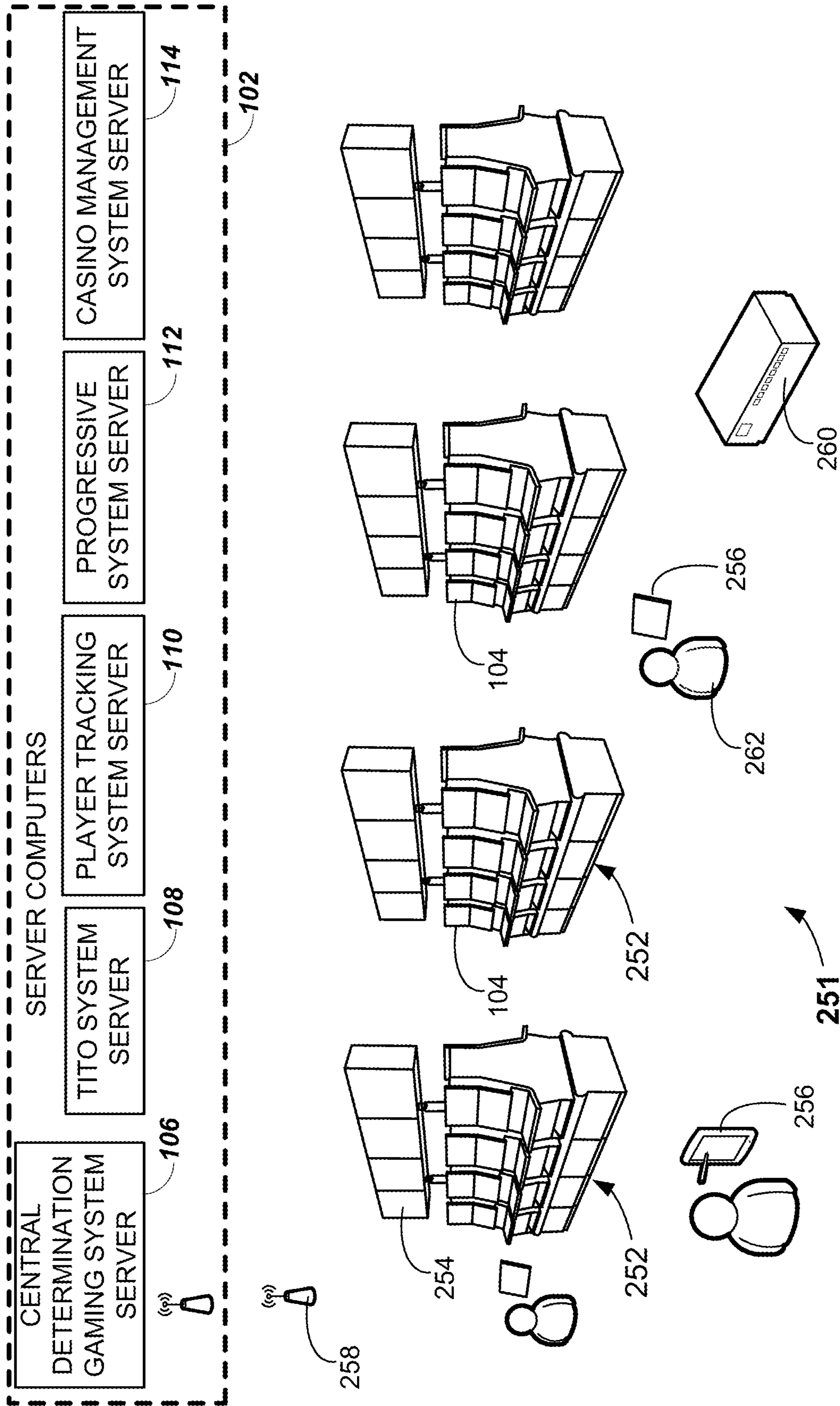
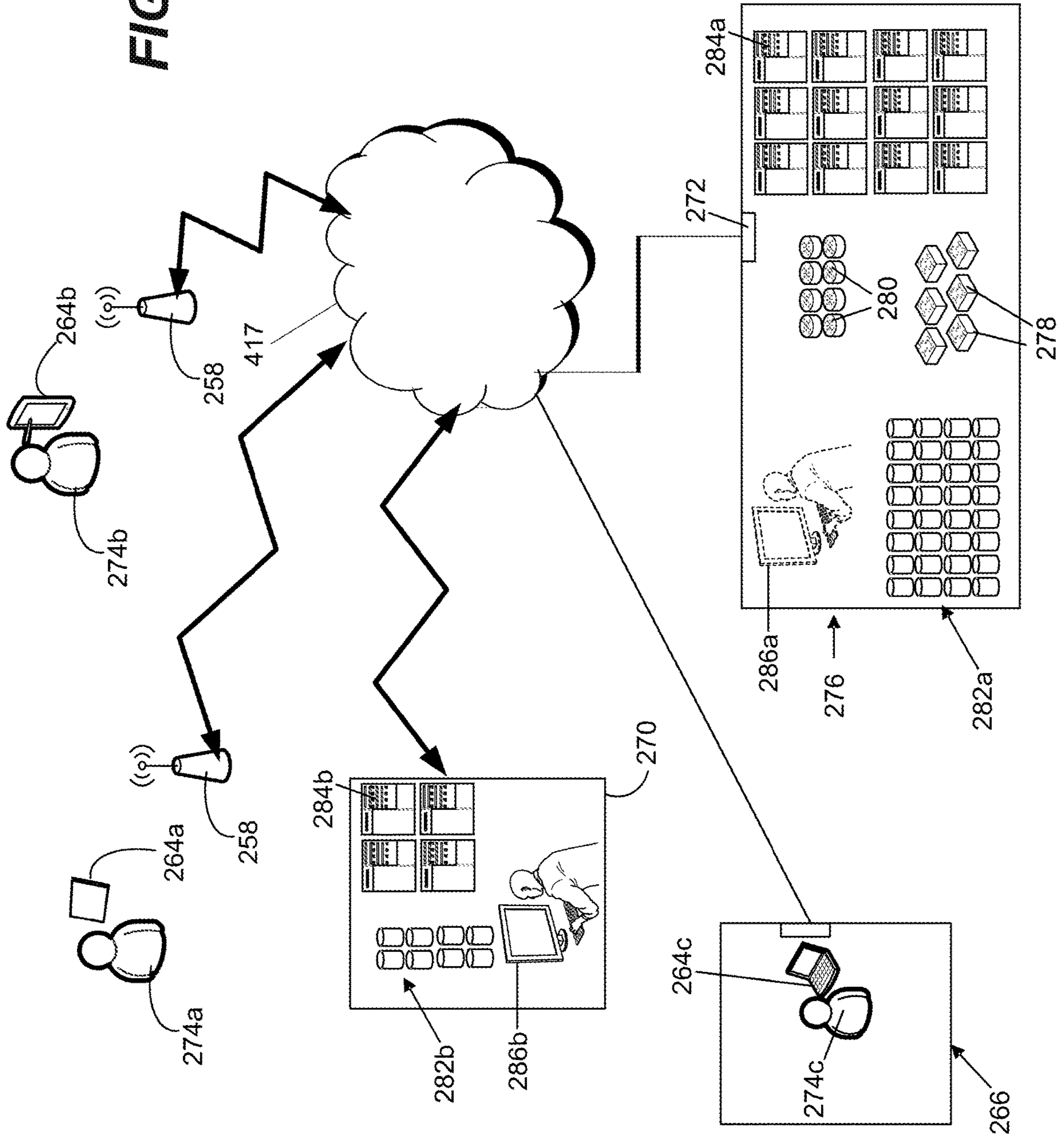
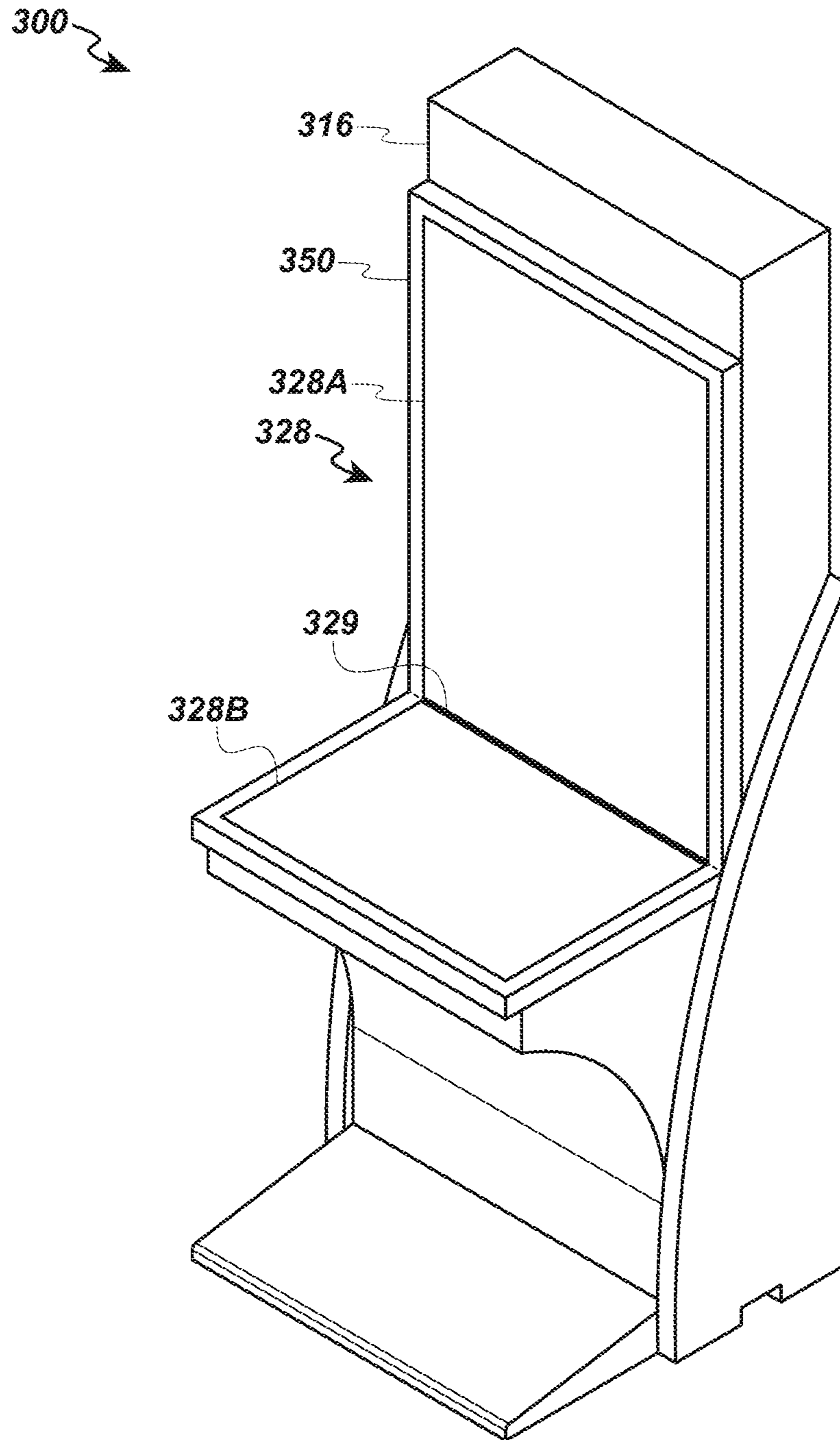


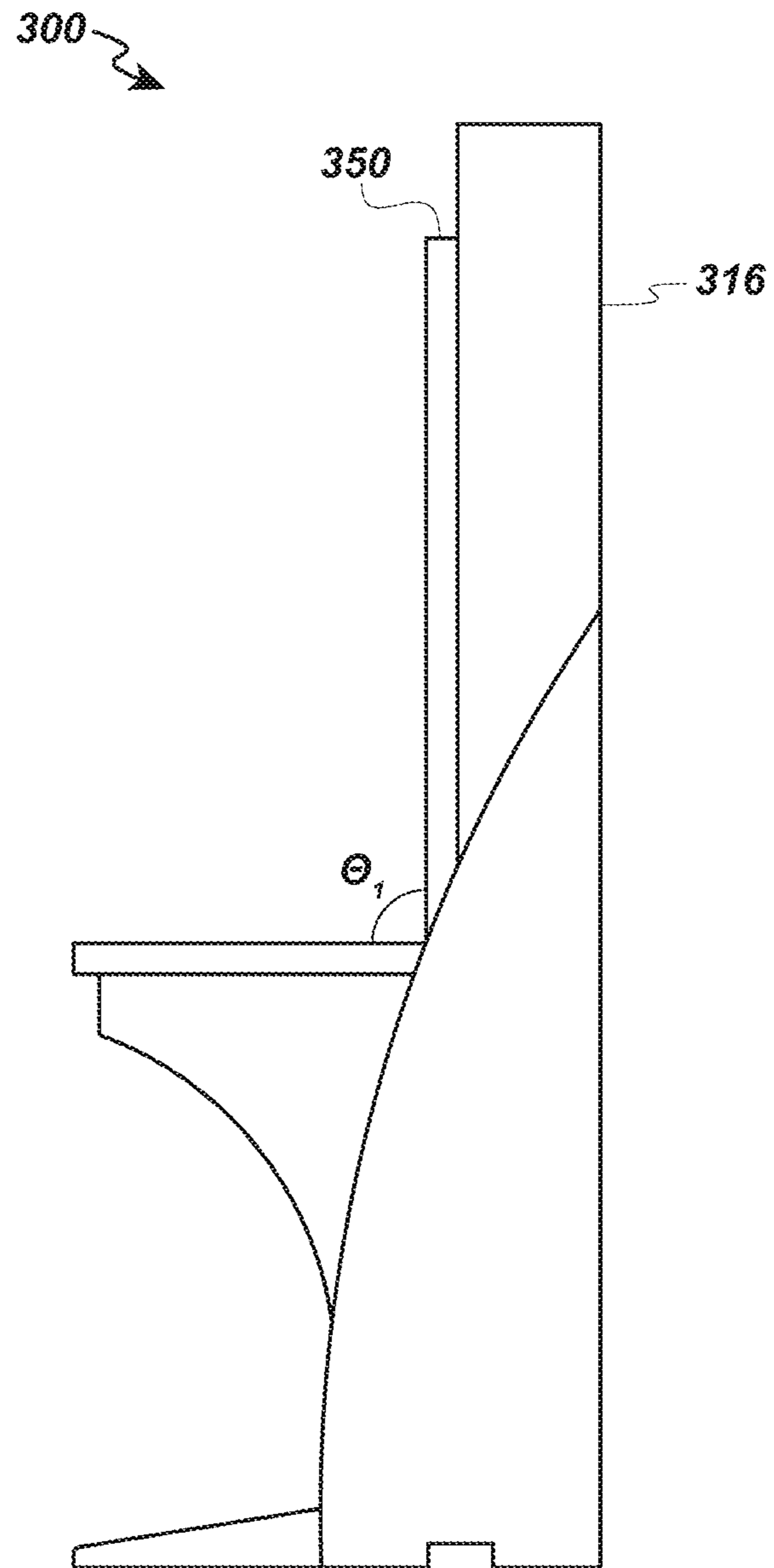
FIG. 2B

FIG. 2C



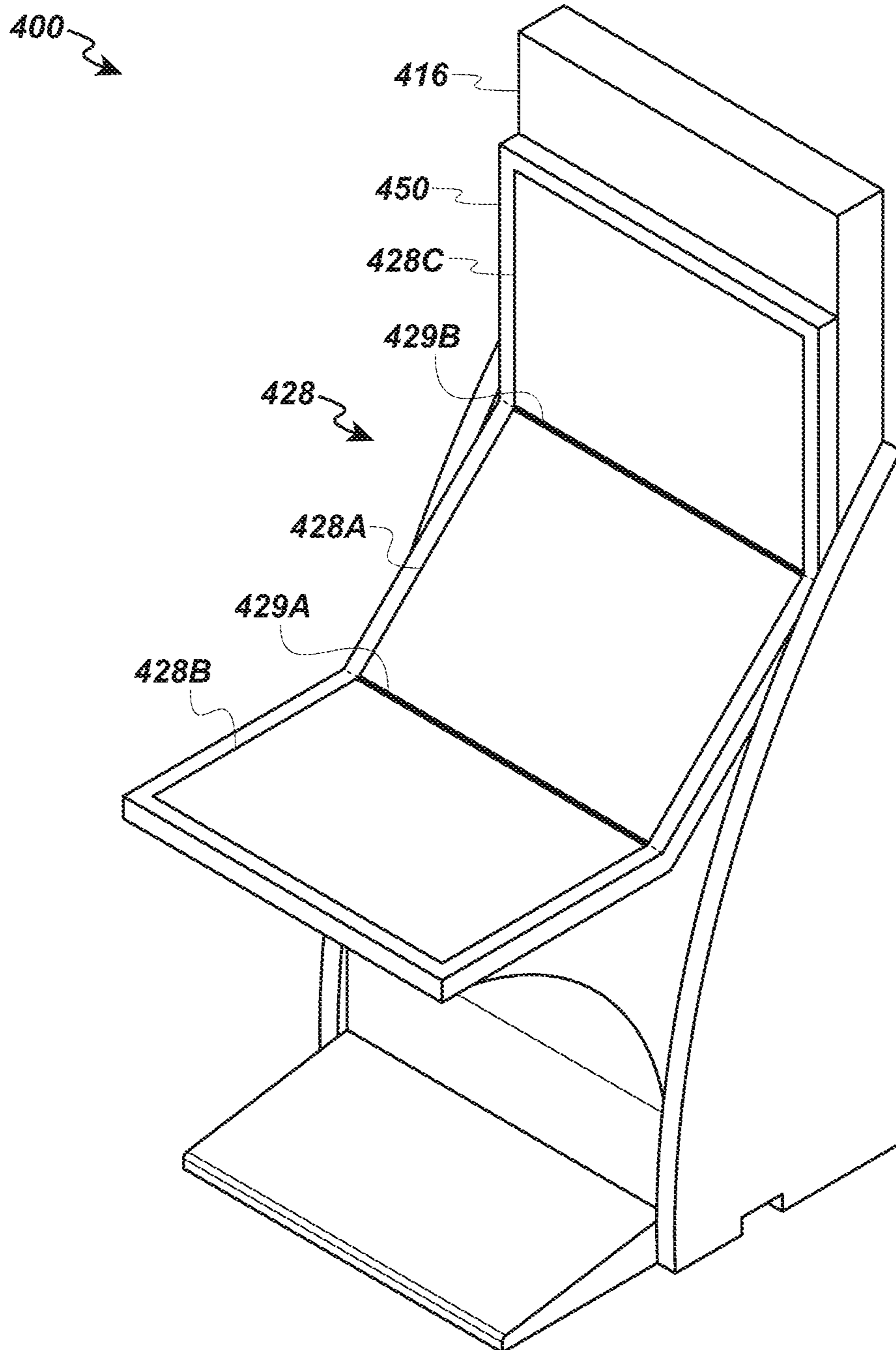


**FIG. 3A**

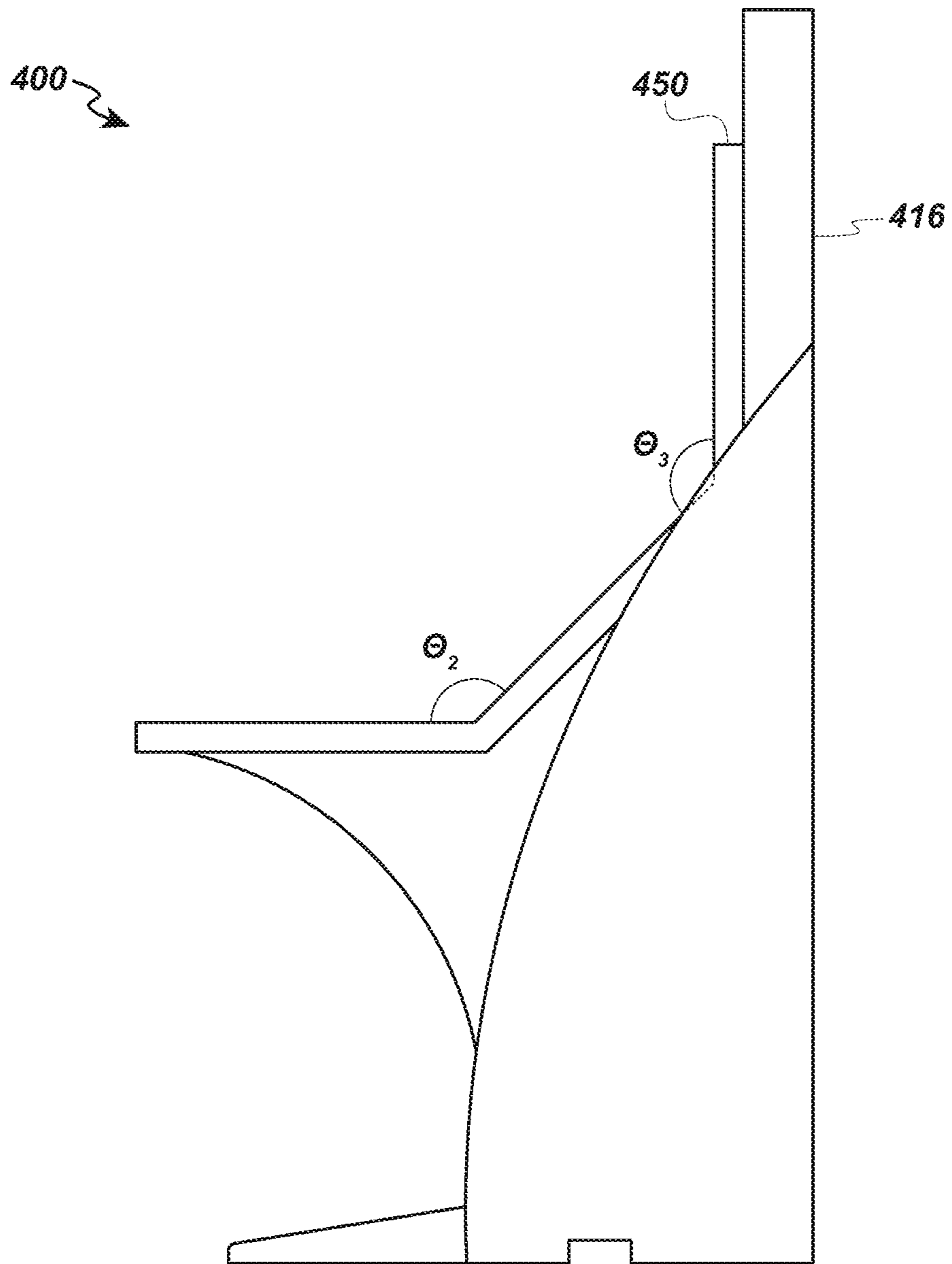


**FIG. 3B**

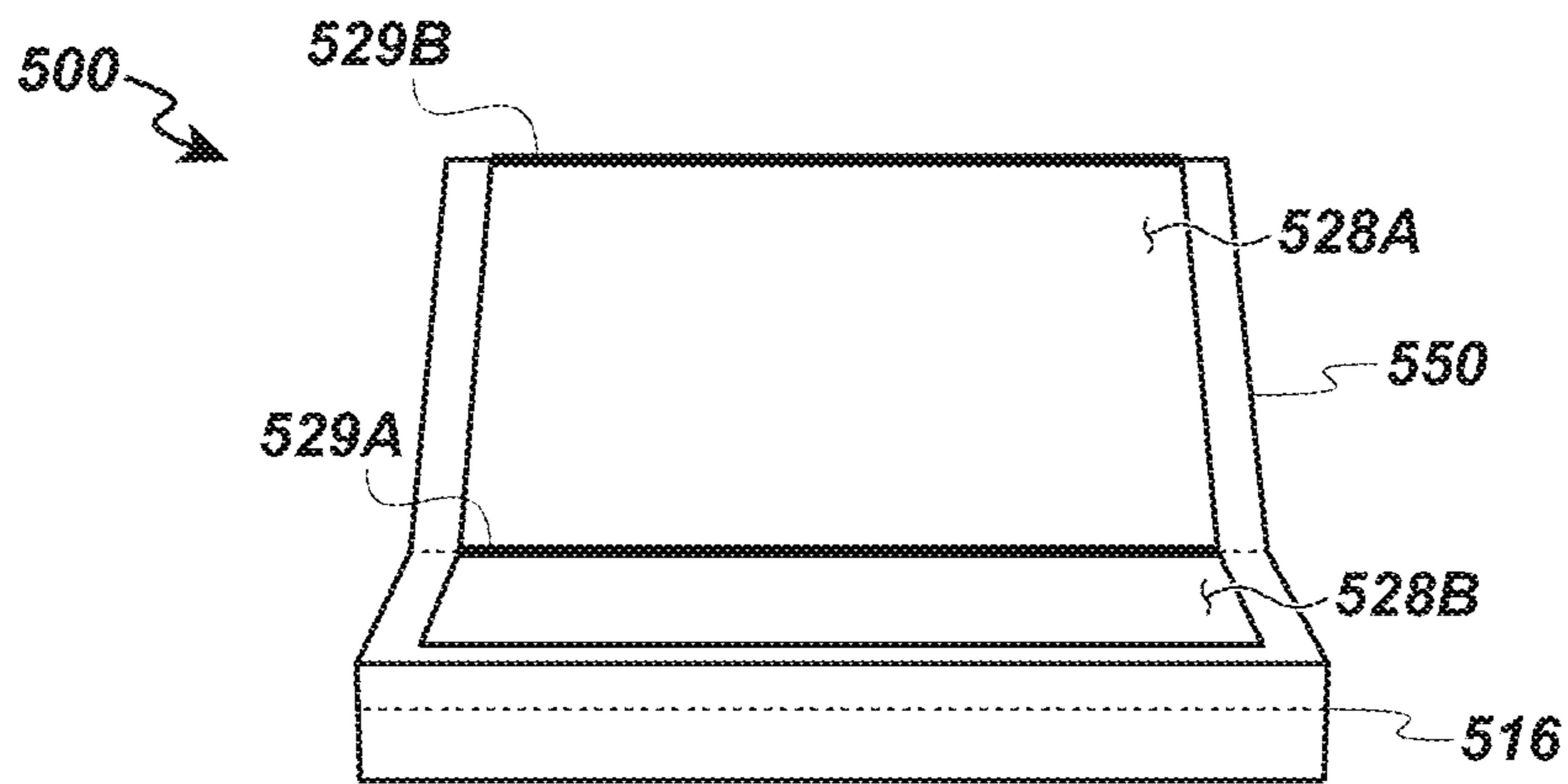




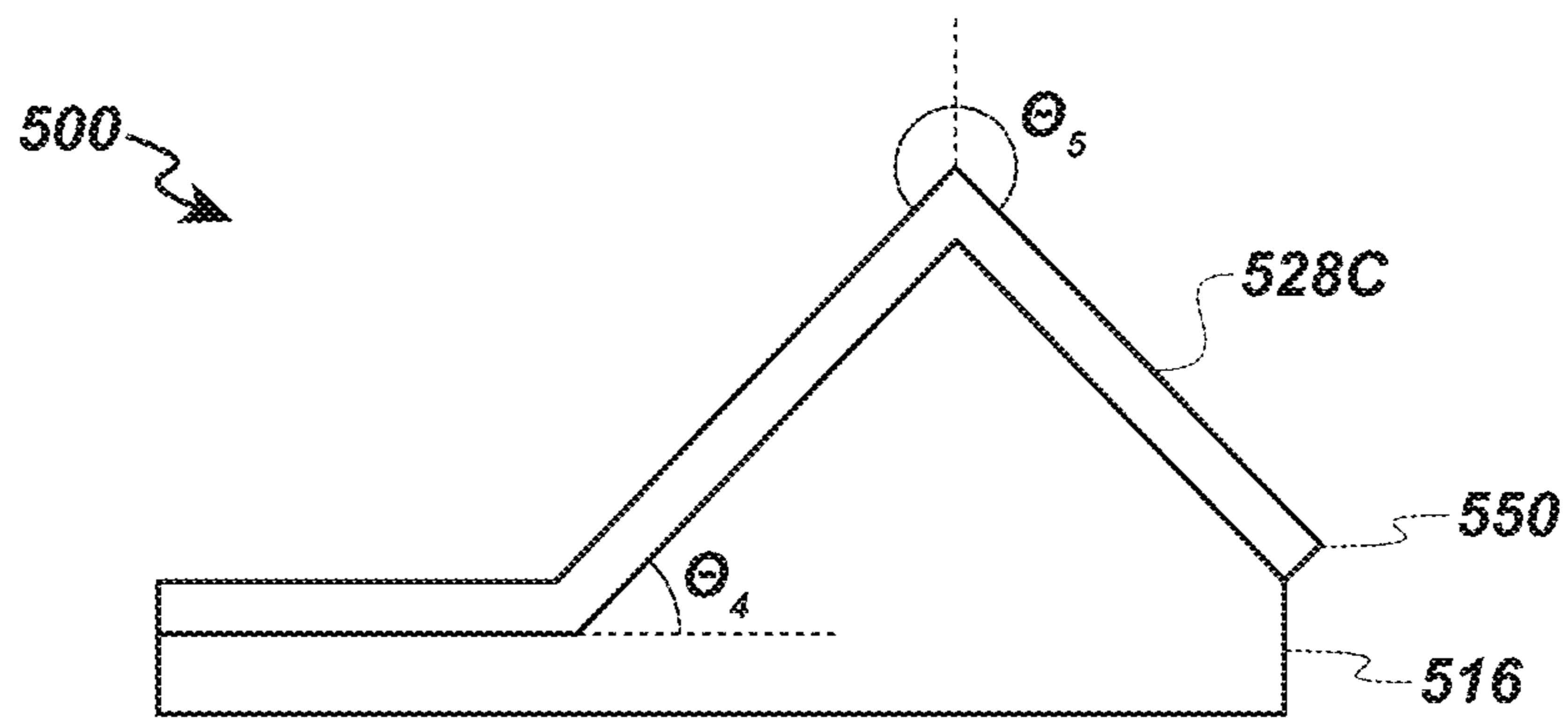
**FIG. 4A**



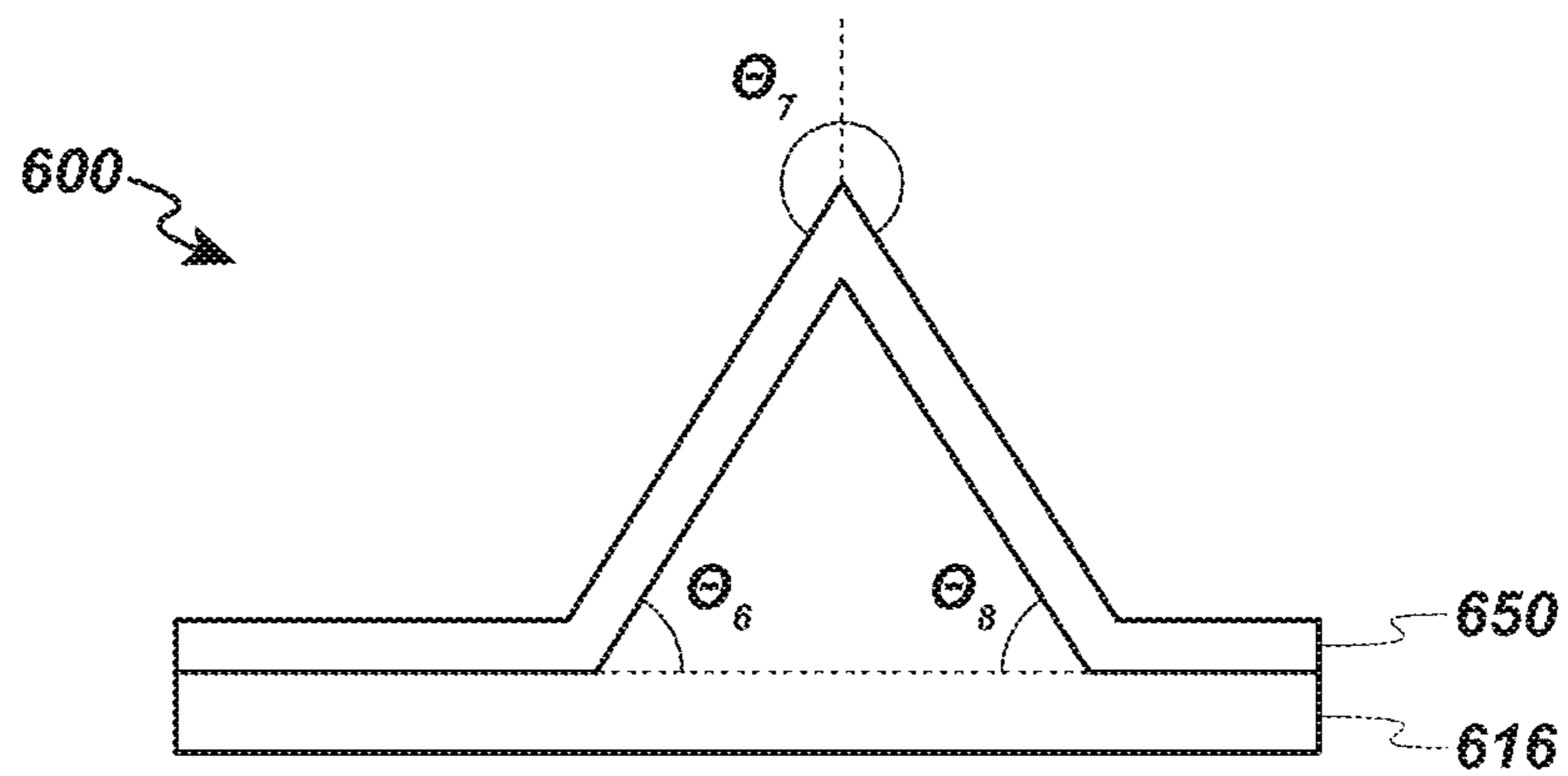
**FIG. 4B**



**FIG. 5A**

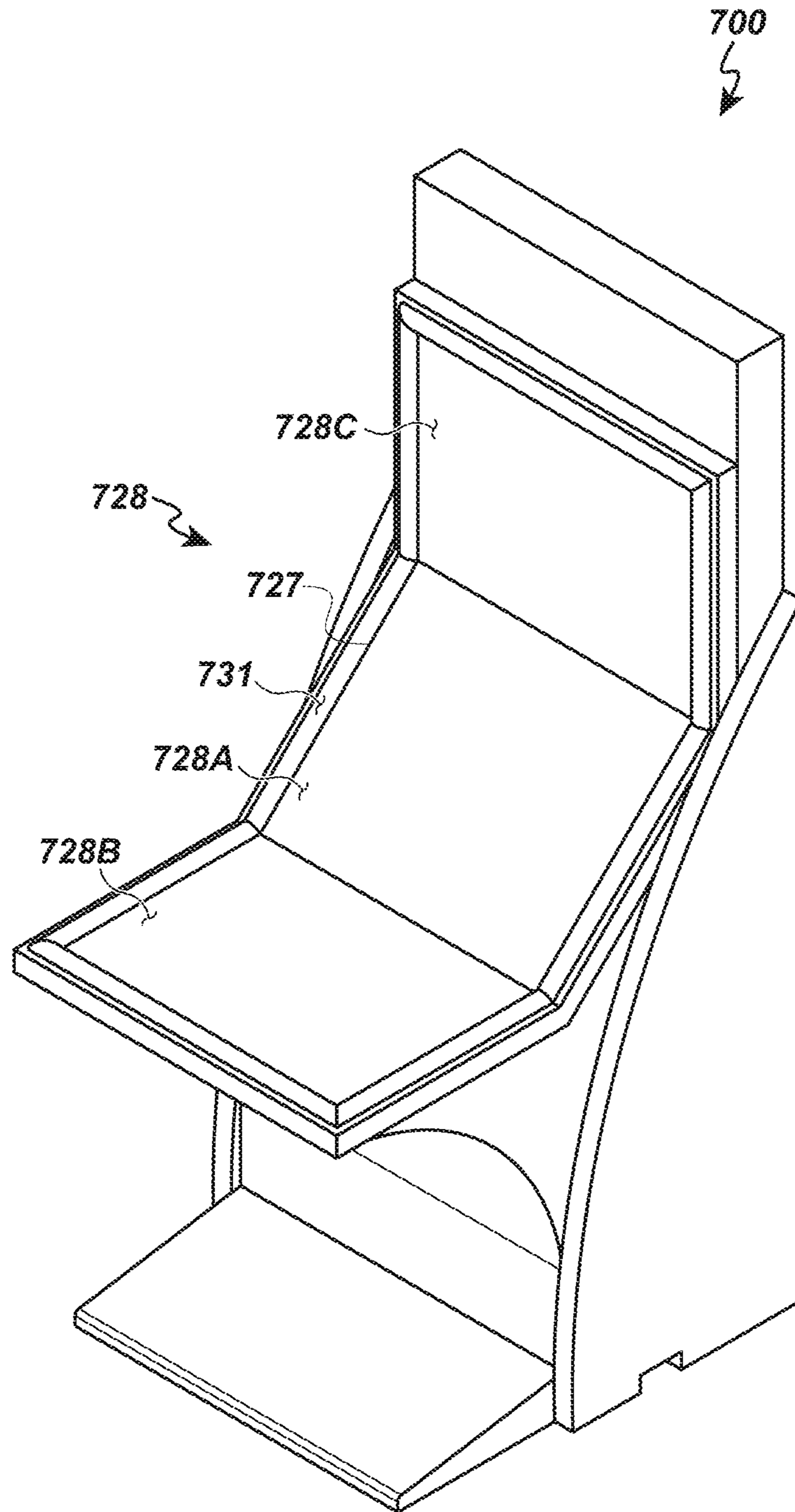


**FIG. 5B**

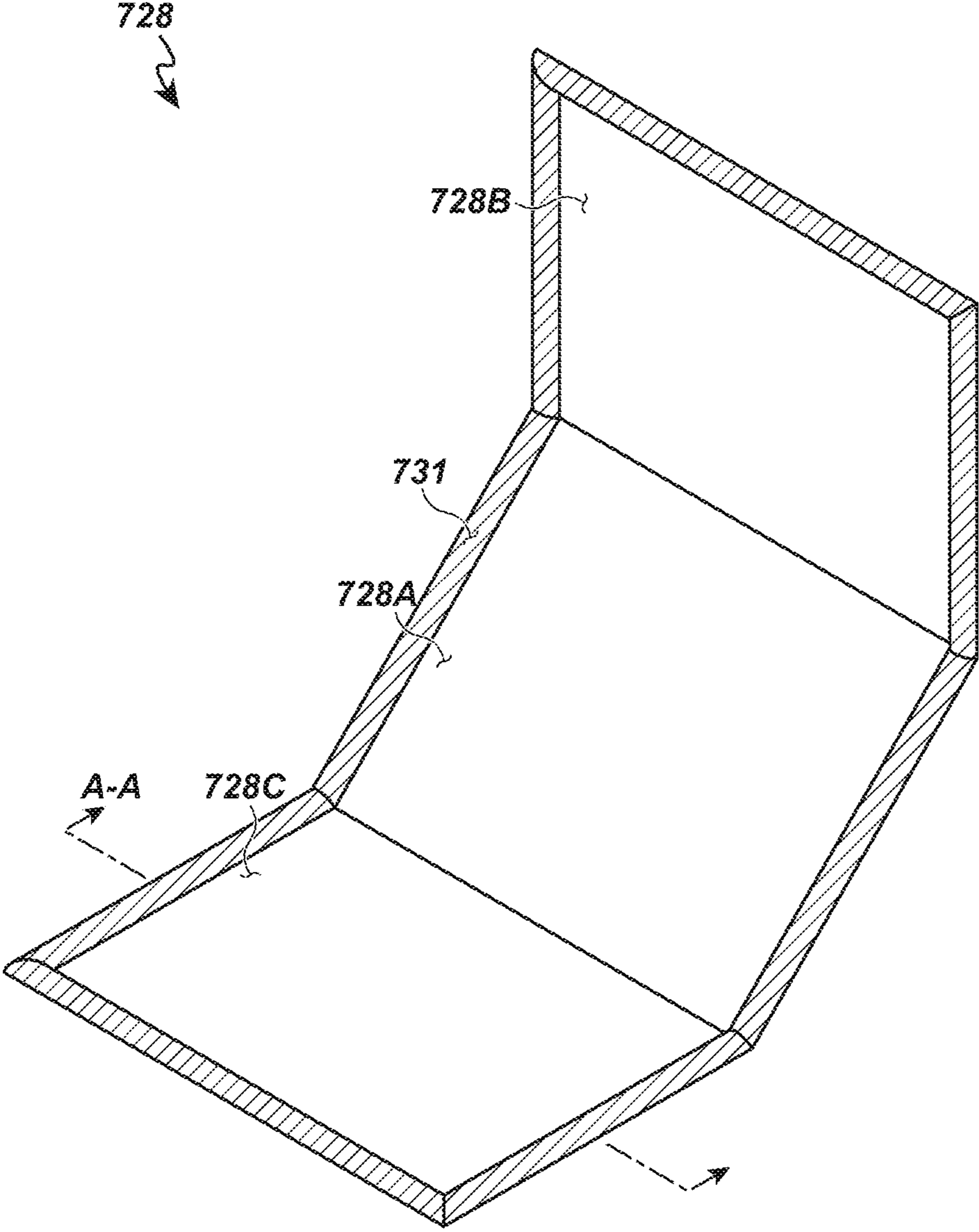


**FIG. 6**

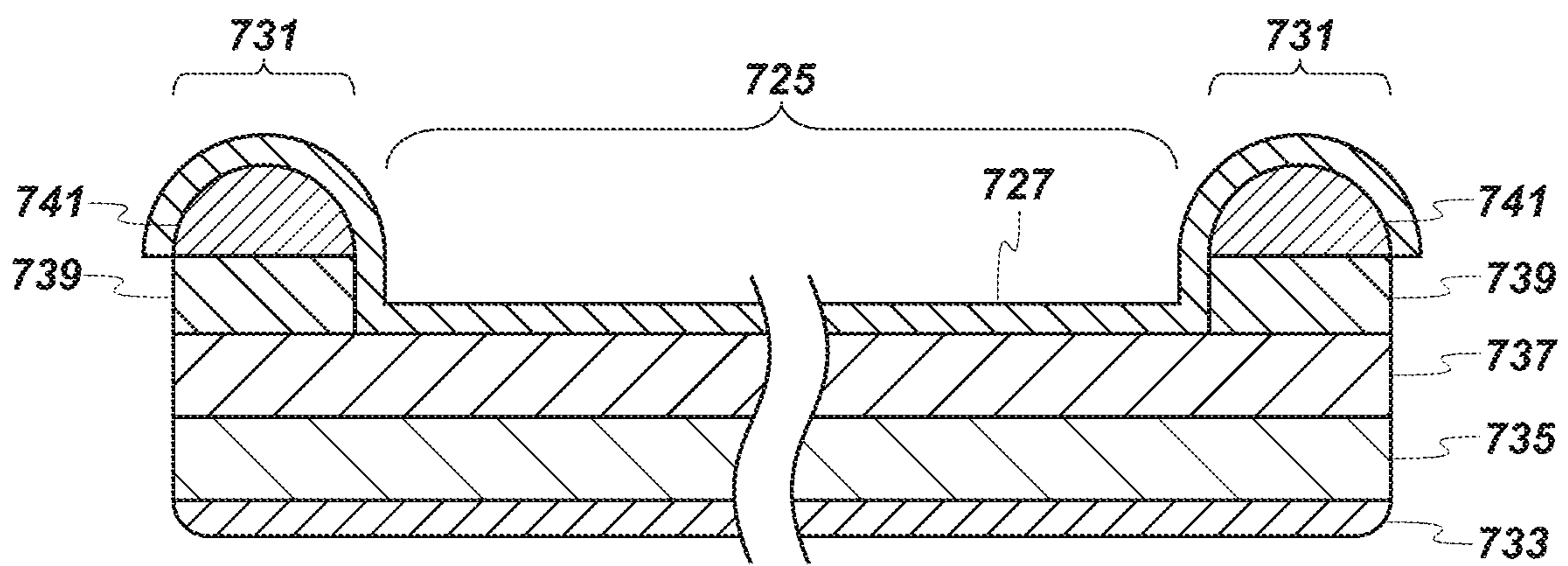




**FIG. 7A**

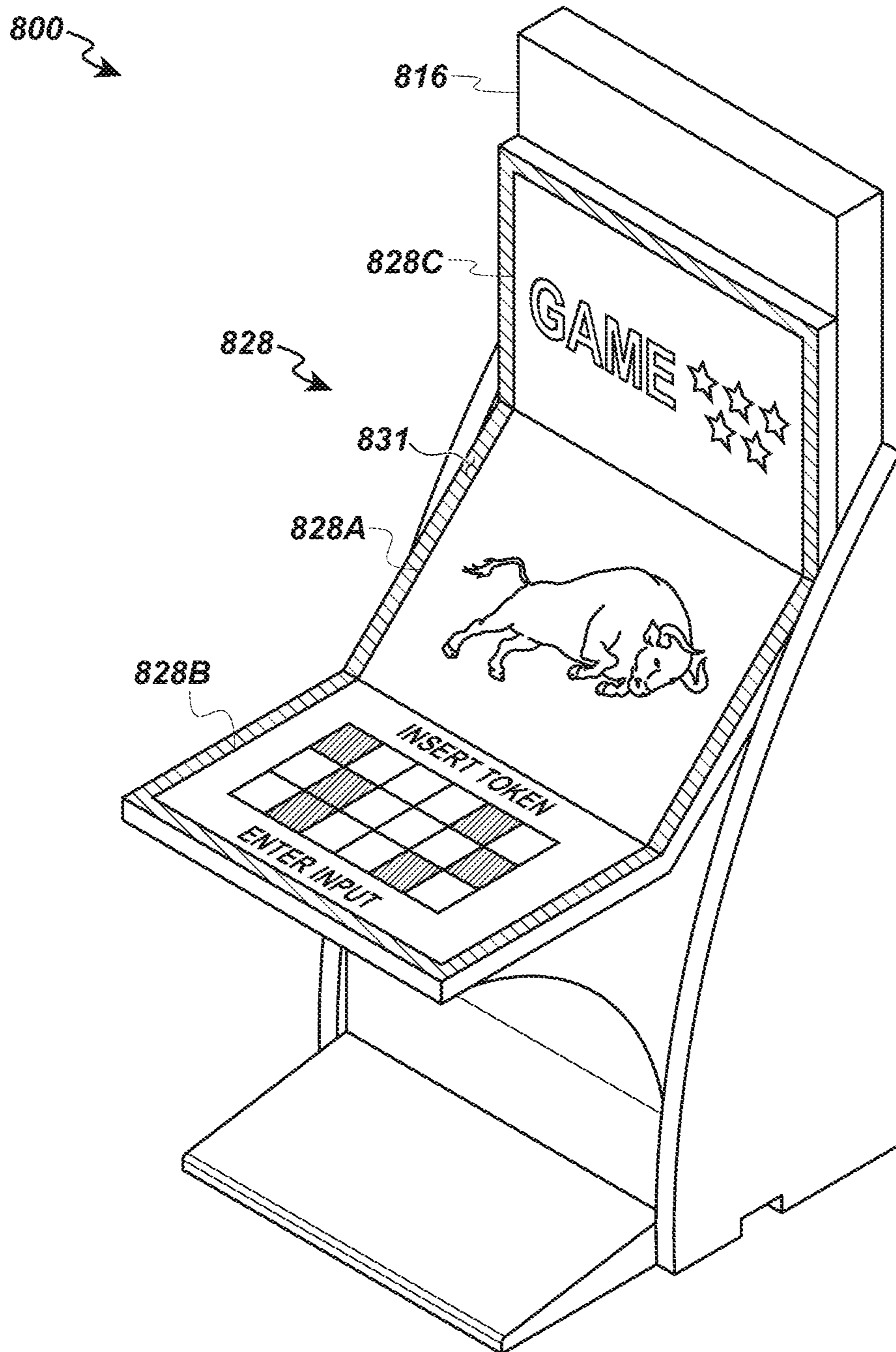


**FIG. 7B**

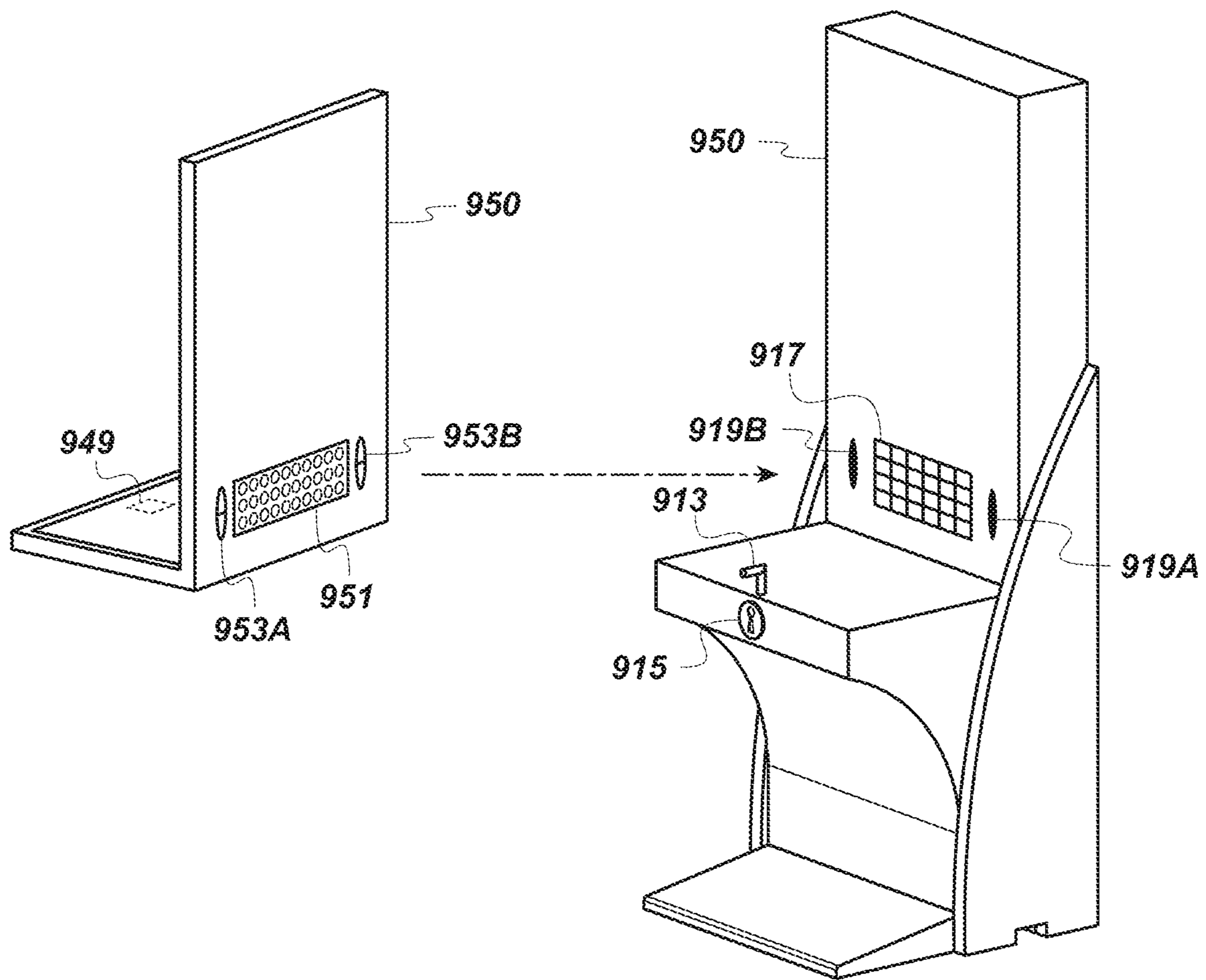


**FIG. 7C**

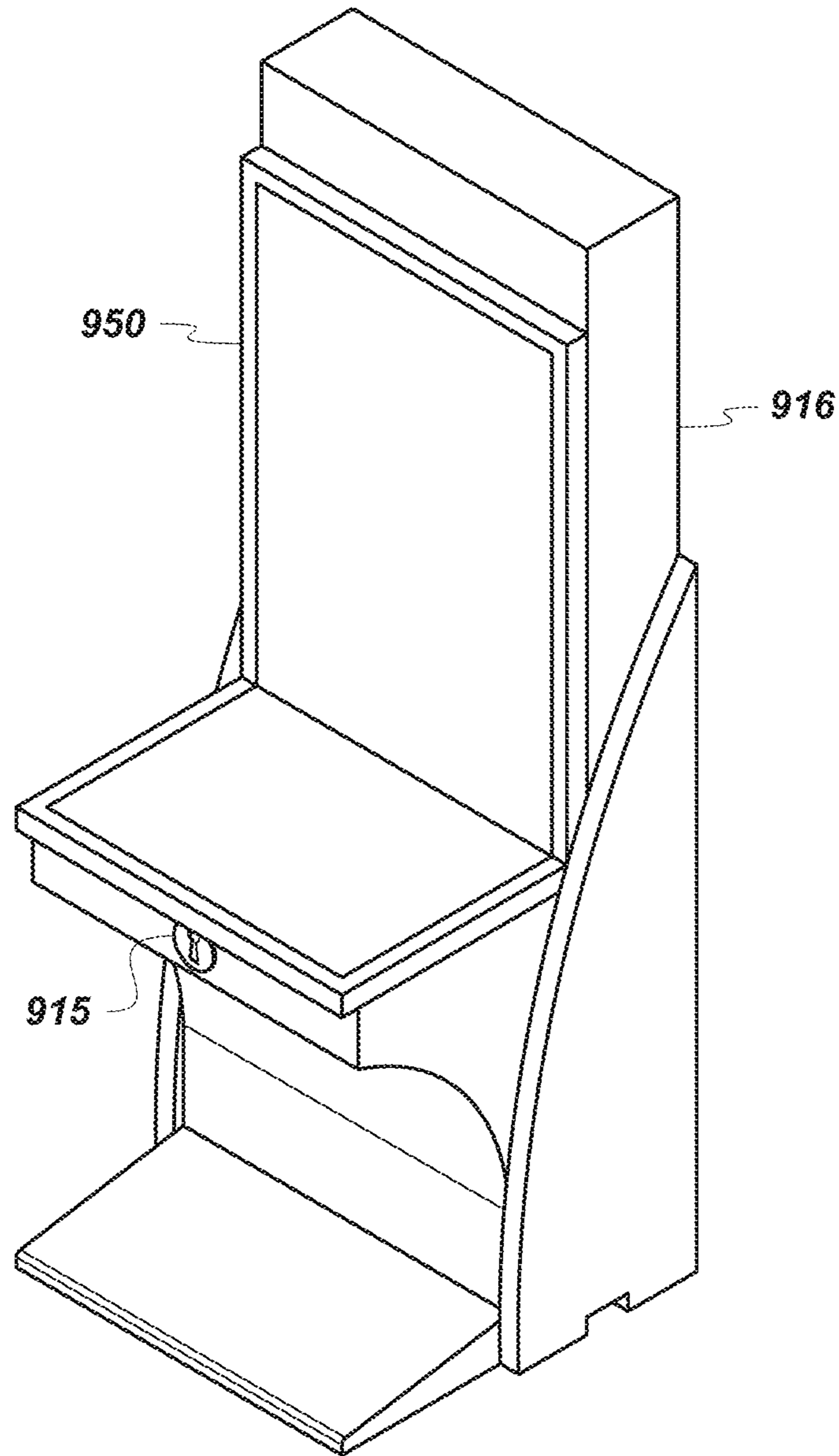




**FIG. 8**



**FIG. 9A**



**FIG. 9B**



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## INTEGRATED EDGE LIGHTING FOR GAMING DEVICE

### CROSS-REFERENCE TO RELATED APPLICATION

This application is a nonprovisional of and claims the benefit under 35 U.S.C. 119(e) of U.S. Provisional Patent Application No. 63/161,831, filed Mar. 16, 2021, the contents of which are incorporated herein by reference as if fully disclosed herein.

### FIELD

The present disclosure generally relates to electronic gaming machines and, more particularly, to a display for an electronic gaming machine.

### BACKGROUND

Electronic gaming machines (“EGMs”) or gaming devices may be used to provide a variety of wagering games such as slot games, video poker games, video blackjack games, roulette games, video bingo games, keno games, and other types of games that are frequently offered at casinos and other locations. Play on EGMs typically involves a player establishing a credit balance by inputting money, or another form of monetary credit, and placing a wager from the credit balance on one or more outcomes of an instance (or single play) of a primary or base game. In some cases, a player may qualify for a special mode of the base game, a secondary game, or a bonus round of the base game by attaining a certain winning combination or triggering event in, or related to, the base game, or after the player is randomly awarded the special mode, secondary game, or bonus round. In the special mode, secondary game, or bonus round, the player is given an opportunity to win extra game credits, game tokens, or other forms of payout. In the case of “game credits” that are awarded during play, the game credits are typically added to a credit meter total on the EGM and may be provided to the player upon completion of a gaming session or when the player wants to “cash out.”

EGMs may include a display, or multiple displays, on which to display graphics or animations to a player. The display may present information concerning the particular wagering game being played. Information provided on the display may be controlled, or otherwise affected, by a player input. In this way, the player may control some aspect of the wagering game including, for example, interacting with graphical elements, making a wager, and so on. Displays may receive a user input (e.g., a touch input) and/or may be operatively coupled to other mechanisms for receiving a player input (e.g., a button or switch).

### SUMMARY

This summary is provided to introduce a selection of concepts in simplified form that are further described below in the Detailed Description. This summary is not intended to identify key or essential features of the claimed subject matter nor is it intended to be used as an aid in determining the scope of the claimed subject matter.

Disclosed herein are gaming devices. The gaming devices may include a main cabinet, a game controller positioned within the main cabinet, and a display assembly coupled to the main cabinet.

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In accordance with the provided disclosure, a gaming device may comprise a main cabinet, a display assembly coupled to the main cabinet and comprising a display panel defining a perimeter region and configured to provide graphical outputs, and a game controller. The game controller may be positioned in the main cabinet and may be configured to control a game provided at the gaming device and drive the perimeter region of the display panel separately from remaining portions of the display panel to illuminate the perimeter region independently by providing edge lighting for the display assembly.

In some implementations, the display assembly may further comprise a glass cover sheet positioned over the display panel and defining a raised perimeter region, a light pipe disposed underneath the raised perimeter region, the light pipe configured to diffuse light within the raised perimeter region, and a gasket positioned between the light pipe and the glass cover sheet. The perimeter region of the display panel may be positioned beneath the raised perimeter region of the glass cover sheet. The perimeter region of the display panel may have a width of about 100 pixels.

In some cases, the display panel may define a first planar display region and a second planar display region offset from the first planar display region by an offset angle. The game controller may be further configured to cause display of gameplay elements corresponding to the game on the first planar display region and cause display of menu elements corresponding to the game on the second planar display region, the gameplay elements and the menu elements controlled independently of the edge lighting. The edge lighting may be illuminated with a particular color that is distinct from the gameplay elements and the menu elements. The edge lighting may comprise one or more animations configured to attract a user’s attention.

In accordance with the provided disclosure, a gaming device may comprise a display assembly comprising a display panel. The display panel may define a display output and an edge lighting output. The gaming device may further comprise a glass cover sheet extending over the display panel, a display assembly housing at least partially surrounding the display panel, and a game controller communicatively coupled with the display panel and configured to independently drive the display output and the edge lighting output.

In some embodiments the gaming device may further comprise a main cabinet comprising a first mechanical connector positioned along a front surface of the main cabinet and a first electrical connector positioned along the front surface of the main cabinet. The display assembly may further comprise a second mechanical connector configured to interface with the first mechanical connector to releasably couple the display assembly to the main cabinet and a second electrical connector configured to contact the first electrical connector when the display assembly is physically coupled to the main cabinet to electrically couple the display assembly to the main cabinet.

The gaming device may further comprise a cabinet lock. When the cabinet lock is in an unlocked position, the first mechanical connector and the second mechanical connector may at least partially detach the display assembly from the main cabinet. When the cabinet lock is in a locked position, the first mechanical connector and the second mechanical connector may couple to secure the display assembly and the main cabinet.

In some cases, the gaming device may further comprise a light pipe disposed underneath the glass cover sheet and configured to diffuse light. The display panel may define a



first planar display region and a second planar display region offset from the first planar display region by an offset angle. The offset angle may be a first offset angle. The display assembly may further comprise a third planar display region offset from the first planar display region by a second offset angle. The first planar display region may be substantially perpendicular with respect to a mounting surface of the main cabinet.

The game controller may control operations of a game associated with the gaming device and the edge lighting is visually distinct from gameplay visuals associated with the game. The display panel may be configured to display the edge lighting and the gameplay visuals.

In accordance with the provided disclosure, a display assembly configured to be coupled with a main cabinet of a gaming device may comprise a display panel defining a perimeter region and configured to provide edge lighting to the perimeter region, a cover sheet extending over the display panel and defining a raised perimeter region disposed above the perimeter region of the display panel, and a light pipe disposed underneath the raised perimeter region, the light pipe configured to diffuse the edge lighting.

The display panel may define a first planar display region configured to provide a first graphical output and a second planar display region configured to provide a second graphical output, the second planar display region offset from the first planar display region by an offset angle. The first graphical output and the second graphical output may be separately controllable with respect to the edge lighting. The edge lighting may be visually distinct from the first graphical output and the second graphical output.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Reference will now be made to representative examples illustrated in the accompanying figures. It should be understood that the following descriptions are not intended to limit the examples to one or more preferred examples. To the contrary, they are intended to cover alternatives, modifications, and equivalents as may be included within the spirit and scope of the described examples as defined by the appended claims. Similar reference numbers have been used, where possible, to designate similar features that are common between the figures.

FIG. 1 is an exemplary diagram showing several electronic gaming machines (EGMs) networked with various gaming related servers.

FIG. 2A is a block diagram showing various functional elements of an exemplary EGM.

FIG. 2B depicts a casino gaming environment according to some examples.

FIG. 2C is a diagram that shows examples of components of a system for providing networked/online gaming according to some aspects of the present disclosure.

FIGS. 3A and 3B depict an example gaming device that includes a display panel with two planar display regions.

FIGS. 4A and 4B depict an example gaming device that includes a display panel with three planar display regions.

FIGS. 5A and 5B depict an alternative example of a gaming device with three planar display regions.

FIG. 6 depicts an example gaming device with four planar display regions.

FIG. 7A depicts an example gaming device that includes a display panel with multiple planar display regions and a raised perimeter region.

FIG. 7B depicts the display panel of FIG. 7A.

FIG. 7C depicts a cross-sectional view of the display panel shown in FIGS. 7A and 7B, taken through section line A-A of FIG. 7B.

FIG. 8 depicts an example gaming device depicting an example user interface (UI) that includes gameplay elements and edge lighting elements.

FIG. 9A depicts an example display assembly and an example main cabinet in a detached state.

FIG. 9B depicts the example display assembly and the example main cabinet of FIG. 9A in an attached state.

The use of cross-hatching or shading in the accompanying figures is generally used to clarify the boundaries between adjacent elements and to facilitate legibility of the figures. Additionally, it should be understood that the proportions and dimensions (either relative or absolute) of the various figures and elements (and collections and groupings thereof), and the boundaries, separations, and positional relationships presented therebetween, are provided in the accompanying figures merely to facilitate an understanding of the various embodiments described herein, may not necessarily be presented or illustrated to scale, and are not intended to indicate any preference or requirement for an illustrated example to the exclusion of examples described with reference thereto.

#### DETAILED DESCRIPTION

The following disclosure generally includes various example implementations related to display assemblies and gaming devices, along with associated components. The display assemblies may include a display panel which may display content related to a game performed by the gaming device or associated components (e.g., a game controller). The display assemblies and associated gaming devices may optionally include quick connect mechanisms configured to attach or detach the display assemblies from the associated gaming devices. Additionally or alternatively, the display assemblies may include one or more components for sensing touch or force inputs on a display surface.

As discussed herein, a display assembly may include a display panel that includes a number of different planar display regions. Each planar display region may be presented at an offset angle with respect to neighboring planar display regions. Due to the planar display regions being presented at different offset angles, user interface elements displayed on a graphical user interface of each respective planar display region may be presented to a player of the gaming device at different angles (e.g., different viewing angles). For example, a first planar display region may be positioned so as to present information at an approximately 90° angle with respect to a neighboring planar display region. A transition between the first planar display region and the second planar display region may define a bent transition region and may be portrayed as a dark (e.g., black) region to visually distinguish neighboring planar display regions. The bent transition region may be depicted as a bright (e.g., white) region and/or may be depicted in any color/brightness to distinguish the bent transition region from neighboring planar display regions. Any number of “bends” or different planar display regions may be provided. In some examples, two planar display regions are provided at two different viewing positions and/or viewing angles to simulate a gaming device with two separate displays. In additional or alternate examples, three planar display regions are provided to simulate a gaming device with three separate displays, though the number of planar display regions is not limited to any particular number.



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Each different planar display region may correspond to different graphical outputs of a game performed by the gaming device and/or game controller. In some examples, a bottom planar display region (e.g., a display region nearest the base of the gaming device) displays a user interface (UI) designed to display graphical elements and to receive a user input. For example, in a keno-type game, the bottom planar display region displays a keno card and permits a user selection thereof. In additional or alternative examples, the bottom planar display region displays a menu that includes a number of selectable options. Additionally or alternatively, the bottom planar display region is, or is a part of, a virtual button deck that includes multiple bet options.

In some implementations, a second planar display region is coupled to the bottom planar display region and is offset from the bottom planar display region by an offset angle. In such cases, the second planar display region displays graphics or animations showing certain functions of gameplay, as discussed herein. Continuing the above example of a keno-type game, the second planar display region displays drawing animations and/or representations of drawn markers. While particular examples are discussed with respect to a UI, these are merely explanatory and any UI may be used in accordance with the provided disclosure.

Incorporating multiple planar display regions at different angles to a player may have the benefit of reducing costs associated with multiple, discrete displays. For example, a gaming device with multiple displays has the benefit of providing an intuitive user experience, as each display displays different information or information categories at different viewing angles. However, multiple displays may be costly, may require complex wiring, or may be prone to multiple points of failure. A single display panel with multiple distinct display regions may provide the benefits of a multi-display gaming device without the added costs of multiple discrete displays.

Aspects of the provided disclosure further relate to integrated edge lighting for a display assembly. As discussed herein, edge lighting may refer to light surrounding the perimeter of a display panel, a planar display region, or a set of planar display regions. For example, an inner region of a display panel displays various UI elements that include game boards, graphics, and/or animations. Edge light may surround these UI elements and may be used to provide emphasis, through the use of light, to the perimeter and/or edge region of the display panel. In some cases, the edge lighting consists of a set number of pixels (e.g., 100 pixels) in a perimeter region of the display panel that at least partially surrounds the inner region. In additional or alternative cases, a light pipe or diffuser is provided over the perimeter region of the display panel to bend and/or blur the edge lighting.

In some examples, edge lighting incorporates radiating or emanating effects such as, for example, pixels which change color and/or brightness to simulate a movement or animation. Continuing the above example, the edge lighting is controlled by the same controller (e.g., a game controller) which controls the UI of an inner region of the display panel. In this way, visual emphasis may be brought to a game device which may attract a player's attention. Further, producing edge lighting using the display panel obviates the need for separate, dedicated edge-lighting hardware.

As described herein, the display assembly may include a glass cover sheet that extends over the display regions defined by the display panel. Various portions of the glass cover sheet may be raised or depressed compared to other portions. In some cases, a perimeter portion of the glass

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cover sheet, corresponding to the perimeter region of the display panel, is raised. The perimeter portion of the glass cover sheet may be raised so as to surround an inner region of the glass cover sheet. The raised perimeter portion may be rolled or may otherwise be extended to have a greater height than the inner region of the glass cover sheet. Since the perimeter portion of the glass cover sheet may be raised, there may be additional room for optical components underneath this portion of the glass cover sheet, and additional elements, such as a light pipe and/or diffuser, may be positioned underneath the perimeter portion. As discussed herein, the light pipe and/or diffuser may soften, bend, and/or blur light provided by the perimeter region of the display, as described above.

In some cases, a gasket (e.g., a rubber gasket) is provided between the glass cover sheet and the light pipe and/or diffuser to protect the edge of the glass cover sheet from impacts by, for example, players. In additional or alternative cases, the raised perimeter portion of the glass cover sheet increases a structural stability of the entire glass cover sheet. For example, in some cases a player may become frustrated and may strike or otherwise apply a force to the glass cover sheet. By increasing a thickness of the raised perimeter portion, a strength of the glass cover sheet may result. In this way, the raised perimeter portion may strengthen the glass cover sheet.

In some cases, a display assembly has features and elements designed for removal from a game cabinet of a gaming device. As provided herein, a gaming device may include both a display assembly and a game cabinet. The display assembly may include a display housing, a display, and other components associated with a display and/or functions of a gaming device. The game cabinet may include a game controller, a power supply, and/or other components of a gaming device/EGM as discussed herein. During the course of many successive operations on a gaming device, certain components may wear out or may otherwise need to be upgraded and/or replaced. In traditional systems with fully integrated displays and game cabinets, replacing specific components may be difficult and may require significant time and effort. This may lead to a loss in revenue, as a non-operational gaming device does not run any games and may waste valuable floor space.

The present disclosure considers embodiments where a display assembly and a game cabinet are modular and/or detachable. In some cases, a display assembly comprises an electrical connector and an attachment mechanism. The electrical connector may be a spring-based electrical system comprising two different components, with respective components positioned on the game cabinet and the display assembly. For example, the display assembly comprises an electrical connector comprised of a conductive material. The electrical connector may include a plunger, a barrel, and a spring. The spring may be coupled to the barrel and may move between a compressed state and an un-compressed state with respect to the barrel. The spring may impart a force on a counterpart electrical connector on, for example, the game cabinet when in an installed state. In this way, the electrical connector may impart a force to a receiving connector, establishing an electrical connection between the display assembly and the game cabinet. This arrangement may also reduce large amounts of internal wiring which may be difficult to repair and may introduce multiple points of failure.

Multiple parts of an attachment mechanism may additionally be provided on both of the display assembly and the game cabinet. For example, the display assembly comprises



multiple paddles coupled to a rear portion thereof. When the display assembly is installed with the game cabinet, internal cables within the game cabinet may couple with the paddles on the display assembly, locking the game cabinet with the display assembly. The cables within the game cabinet may be loosened in response to an unlocking operation (e.g., unlocking a lock or squeezing a trigger) which may fully or partially decouple the display assembly from the game cabinet. In some cases, the cables causes a force to forcibly separate the display assembly from the game cabinet. The display assembly may additionally be provided with grips so that an operator may grasp the display assembly for removal or installation. In some cases, the grips are positioned in the same location as the paddle assemblies and are formed from a structure of the paddle assemblies. In this way, replacement of, for example, a malfunctioning display assembly (or any display assembly being replaced) may be made quickly and with minimal, or no, required tools.

As described herein, the provided disclosure generally provides solutions to one or more technical problems which may be present in traditional systems. For example, as described above, multiple displays have the benefit of providing a large amount of graphical information to a user. In some cases, the multiple displays provide respective graphical information at different viewing angles, so as to increase a user's immersion with an associated apparatus. However, multiple displays may increase the cost, complexity, assembly requirements, and/or maintenance requirements of a system. In some cases, each additional, discrete display requires the purchase of the additional display. Further, multiple, discrete displays may require more complex wiring, interconnections, and internal components to connect and/or harmonize the multiple displays. Yet further, the assembly and maintenance efforts associated with installing, replacing, and fixing multiple displays and components associated with the multiple displays may require a large amount of time and/or effort, due to the complexity of the interconnected systems, which may result in costly downtime of the apparatus.

To rectify these issues, and other associated issues, the present disclosure discusses a single display separated into multiple display regions and associated components. As a single display may be bought, installed, and/or maintained as a single unit, the benefits of providing multiple viewing angles to a user may be maintained while the drawbacks of multiple components, as described above, may be avoided. For example, a single display is quickly installed, contains integrated electrical components, and is otherwise treated as a single unit. Other associated features, such as integrating lighting into a display assembly and providing connect/disconnect structures, may further reduce cost and/or complexity of a game cabinet.

FIG. 1 illustrates several different models of EGMs which may be networked to various gaming related servers. Shown is a system 100 in a gaming environment that includes one or more server computers 102 (e.g., slot servers of a casino) that are in communication, via a communications network, with one or more gaming devices 104A-104X (EGMs, slots, video poker, bingo machines, etc.) that may implement one or more aspects of the present disclosure. The gaming devices 104A-104X may alternatively be portable and/or remote gaming devices such as, but not limited to, a smart phone, a tablet, a laptop, or a game console. Gaming devices 104A-104X may utilize specialized software and/or hardware to form non-generic, particular machines or appara-

tuses that comply with regulatory requirements regarding devices used for wagering or games of chance that provide monetary awards.

Communication between the gaming devices 104A-104X and the server computers 102, and among the gaming devices 104A-104X, may be direct or indirect using one or more communication protocols. As an example, gaming devices 104A-104X and the server computers 102 may communicate over one or more communication networks, such as over the Internet through a website maintained by a computer on a remote server or over an online data network including commercial online service providers, Internet service providers (ISPs), private networks (e.g., local area networks (LANs) and enterprise networks), and the like (e.g., wide area networks). The communication networks could allow gaming devices 104A-104X to communicate with one another and/or the server computers 102 using a variety of communication-based technologies, such as radio-frequency (RF) (e.g., wireless fidelity (WiFi®) and Bluetooth®), cable TV, satellite links, and so on.

In some implementations, server computers 102 may not be necessary and/or preferred. For example, in one or more implementations, a stand-alone gaming device such as gaming device 104A, gaming device 104B or any of the other gaming devices 104C-104X may implement one or more aspects of the present disclosure. However, it is typical to find multiple EGMs connected to networks implemented with one or more of the different server computers 102 described herein.

The server computers 102 may include a central determination gaming system server 106, a ticket-in-ticket-out (TITO) system server 108, a player tracking system server 110, a progressive system server 112, and/or a casino management system server 114. Gaming devices 104A-104X may include features to enable operation of any or all servers for use by the player and/or operator (e.g., the casino, resort, gaming establishment, tavern, pub, and so on). For example, game outcomes may be generated on a central determination gaming system server 106 and may then be transmitted over the network to any of a group of remote terminals or remote gaming devices 104A-104X that utilize the game outcomes and display the results to the players.

A gaming device 104A is often of a cabinet construction which may be aligned in rows or banks of similar devices for placement and operation on a casino floor. The gaming device 104A may include a main door which provides access to the interior of a main cabinet 116. The gaming device 104A may further include a button area or button deck 120 accessible by a player that is configured with input switches or buttons 122, an access channel for a bill validator 124, and/or an access channel for a ticket-out printer 126.

In FIG. 1, the gaming device 104A is shown as a ReIm XL™ model gaming device manufactured by Aristocrat® Technologies, Inc. As shown, the gaming device 104A is a reel machine having a gaming display area 118 comprising a number (typically 3 or 5) of mechanical reels 130 with various symbols displayed on them. The mechanical reels 130 may be independently spun and stopped to show a set of symbols within the gaming display area 118 and may be used to determine an outcome to a game.

In many configurations, the gaming device 104A may have a main display 128 (e.g., a video display monitor) mounted to, or above, the gaming display area 118. The main display 128 may be a high-resolution liquid crystal display (LCD), plasma, light-emitting diode (LED), organic light emitting diode (OLED) panel, which may be flat or curved



as shown, a cathode ray tube, or other conventional electronically controlled video monitor.

In some implementations, the bill validator **124** may also function as a “ticket-in” reader that allows the player to use a casino issued credit ticket to load credits onto the gaming device **104A** (e.g., in a cashless ticket TITO system). In such cashless implementations, the gaming device **104A** may also include a “ticket-out” printer **126** for outputting a credit ticket when a “cash out” button is pressed. Cashless TITO systems may be used to generate and track unique bar-codes or other indicators printed on tickets to allow players to avoid the use of bills and coins by loading credits using a ticket reader and cashing out credits using a ticket-out printer **126** on the gaming device **104A**. The gaming device **104A** may additionally have hardware meters for purposes including ensuring regulatory compliance and monitoring the player credit balance. In addition, there may be additional meters that record the total amount of money wagered on the gaming device, the total amount of money deposited, the total amount of money withdrawn, the total amount of winnings on gaming device **104A**, and so on.

In some implementations, a player tracking card reader **144**, a transceiver for wireless communication with a mobile device (e.g., a player’s smartphone), a keypad **146**, and/or an illuminated display **148** for reading, receiving, entering, and/or displaying player tracking information may be provided in gaming device **104A**. In such implementations, a game controller within the gaming device **104A** may communicate with the player tracking system server **110** to send and receive player tracking information.

Gaming device **104A** may also include a bonus topper wheel **134**. When bonus play is triggered (e.g., by a player achieving a particular outcome or set of outcomes in the primary game), the bonus topper wheel **134** may be operative to spin and stop with indicator arrow **136** indicating the outcome of the bonus game. The bonus topper wheel **134** may be used to play a bonus game, but could also be incorporated into play of the base or primary game.

A candle **138** may be mounted on the top of gaming device **104A** and may be activated by a player (e.g., using a switch or one of buttons **122**) to indicate to operations staff that gaming device **104A** has experienced a malfunction or the player requires service. The candle **138** may also be used to indicate a jackpot has been won and to alert staff that a hand payout of an award may be needed.

There may also be one or more information panels **152** which may be a back-lit, silkscreened glass panel with lettering to indicate general game information including, for example, a game denomination (e.g., \$0.25 or \$1), pay lines, pay tables, and/or various game related graphics. In some implementations, the information panel(s) **152** may be implemented as an additional video display.

Gaming devices **104A** may also include a handle **132** typically mounted to the side of main cabinet **116** which may be used to initiate gameplay.

Many or all the above described components may be controlled by circuitry (e.g., a game controller) housed inside the main cabinet **116** of the gaming device **104A**, the details of which are shown in FIG. 2A.

An alternative example gaming device **104B** illustrated in FIG. 1 is the Arc™ model gaming device manufactured by Aristocrat® Technologies, Inc. Note that, where possible, reference numerals identifying similar features of the gaming device **104A** implementation are also identified in the gaming device **104B** implementation using the same reference numbers. The gaming device **104B** may not include physical reels and may instead show gameplay functions on

a main display **128**. An optional topper screen **140** may be used as a secondary game display for bonus play, to show game features or attraction activities while a game is not in play, or any other information or media desired by the game designer or operator. In some implementations, the optional topper screen **140** may also or alternatively be used to display progressive jackpot prizes available to a player during play of gaming device **104B**.

Example gaming device **104B** may include a main cabinet **116** including a main door which opens to provide access to the interior of the gaming device **104B**. The main or service door may be used by service personnel to refill the ticket-out printer **126** and collect bills and tickets inserted into the bill validator **124**. The main or service door may also be accessed to reset the machine, verify and/or upgrade the software, and for general maintenance operations.

Another example gaming device **104C** shown is the Helix™ model gaming device manufactured by Aristocrat® Technologies, Inc. The gaming device **104C** may include a main display **128A** that is in a landscape orientation. Although not illustrated by the front view provided, the main display **128A** may have a curvature radius from top to bottom, or alternatively from side to side. In some implementations, the main display **128A** may be a flat panel display. The main display **128A** may be used for primary gameplay while a secondary display **128B** may be used for bonus gameplay, to show game features or attraction activities while the game is not in play, or any other information or media desired by the game designer or operator. In some implementations, the example gaming device **104C** may also include speakers **142** to output various audio such as game sound, background music, etc.

Many different types of games, including mechanical slot games, video slot games, video poker, video black jack, video pachinko, keno, bingo, and lottery, may be provided with or implemented within the depicted gaming devices **104A-104C** and other similar gaming devices. Each gaming device may also be operable to provide many different games. Games may be differentiated according to themes, sounds, graphics, type of game (e.g., slot game vs. card game vs. game with aspects of skill), denomination, number of paylines, maximum jackpot, progressive or non-progressive, bonus games, and so on, and may be deployed for operation in Class 2, Class 3, and so on. The gaming device **104X** may represent any kind of gaming device and may include components similar to those in depicted gaming devices **104A-104C**.

FIG. 2A is a block diagram depicting exemplary internal electronic components of a gaming device **200** connected to various external systems. All or parts of the gaming device **200** shown could be used to implement any one of the example gaming devices **104A-104X** depicted in FIG. 1. As shown in FIG. 2A, the gaming device **200** includes a topper display **216** or another form of a top box (e.g., a topper wheel, a topper screen, and so on) that sits above a cabinet **218**. The cabinet **218** or topper display **216** may also house a number of other components which may be used to add features to a game being played on gaming device **200**, including speakers **220**, a ticket printer **222** which prints bar-coded tickets or other media or mechanisms for storing or indicating a player’s credit value, a ticket reader **224** which reads bar-coded tickets or other media or mechanisms for storing or indicating a player’s credit value, and a player tracking interface **232**. The player tracking interface **232** may include a keypad **226** for entering information, a player tracking display **228** for displaying information (e.g., an illuminated or video display), and a card reader **230** for



receiving data and/or communicating information to and from media or a device such as a smart phone enabling player tracking. FIG. 2 also depicts utilizing a ticket printer 222 to print tickets for a TITO system server 108. The gaming device 200 may further include a bill validator 234, 5 player-input buttons 236 for player input, cabinet security sensors 238 to detect unauthorized opening of the cabinet 218, a primary game display 240, and a secondary game display 242, each display coupled to and operable under the control of a game controller 202.

The games available for play on the gaming device 200 may be controlled by a game controller 202 that includes a processor 204. The processor 204 may represent a general-purpose processor, a specialized processor intended to perform certain functional tasks, a combination thereof, and so on. As an example, the processor 204 may be a central processing unit (CPU) that has one or more multi-core processing units and memory mediums (e.g., cache memory) that function as buffers and/or temporary storage for data. Alternatively, the processor 204 may be a specialized processor, such as an application specific integrated circuit (ASIC), graphics processing unit (GPU), field-programmable gate array (FPGA), digital signal processor (DSP), or another type of hardware accelerator. In another example, the processor 204 may be a system on chip (SoC) 15 that combines and integrates one or more general-purpose processors and/or one or more specialized processors. Although FIG. 2A illustrates that the game controller 202 includes a single processor 204, the game controller 202 is not limited to this representation and may include multiple 20 processors 204 (e.g., two or more processors).

FIG. 2A illustrates that the processor 204 is operatively coupled to a memory 208. The memory 208 is defined herein as including volatile and/or nonvolatile memory and other types of non-transitory data storage components. Volatile 25 memory is memory that does not retain data values upon loss of power. Nonvolatile memory is memory that does retain data upon a loss of power. Examples of the memory 208 include random access memory (RAM), read-only memory (ROM), hard disk drives, solid-state drives, universal serial bus (USB) flash drives, memory cards accessed via a memory card reader, floppy disks accessed via an associated floppy disk drive, optical discs accessed via an optical disc drive, magnetic tapes accessed via an appropriate tape drive, and/or other memory components, a combination of any two 30 or more of these memory components, and so on. In addition, examples of RAM include static random access memory (SRAM), dynamic random access memory (DRAM), magnetic random access memory (MRAM), and other devices. Examples of ROM include a programmable read-only memory (PROM), an erasable programmable read-only memory (EPROM), an electrically erasable programmable read-only memory (EEPROM), or other memory device. Even though FIG. 2A illustrates that the game controller 202 includes a single memory 208, game 35 controller 202 could include multiple memories 208 for storing program instructions and/or data.

The memory 208 may store one or more game programs 206 that provide program instructions and/or data for carrying out various implementations (e.g., game mechanics) 40 described herein. Stated another way, a game program 206 represents an executable program stored in any portion or component of the memory 208. In one or more implementations, the game program 206 is embodied in the form of source code that includes human-readable statements written in a programming language or machine code that contains numerical instructions recognizable by a suitable

execution system, such as a processor 204 in a game controller 202 or other system. Examples of executable programs include: (1) a compiled program that may be translated into machine code in a format that may be loaded into a random access portion of a memory 208 and run by processor 204; (2) source code that may be expressed in proper format such as object code that is capable of being loaded into a random access portion of a memory 208 and executed by a processor 204; and (3) source code that may 5 be interpreted by another executable program to generate instructions in a random access portion of a memory 208 to be executed by a processor 204.

Alternatively, a game program 206 may be set up to generate one or more game instances based on instructions and/or data that the gaming device 200 exchanges with one or more remote gaming devices, such as a central determination gaming system server 106 (not shown in FIG. 2A but depicted in FIG. 1). For purpose of this disclosure, the term “game instance” refers to a play or a round of a game that the gaming device 200 presents (e.g., via a user interface (UI)) to a player. The game instance may be communicated to the gaming device 200 via the network 214 and then displayed on gaming device 200. For example, the gaming device 200 may execute the game program 206 as video 15 streaming software that allows the game to be displayed on the gaming device 200. When a game is stored on the gaming device 200, it may be loaded from the memory 208 (e.g., from a read only memory (ROM)) or from the central determination gaming system server 106 to the memory 208.

Gaming devices, such as the gaming device 200, are highly regulated to ensure fairness and, in some cases, the gaming device 200 is operable to award monetary awards (e.g., dispensed in the form of a redeemable voucher). Therefore, to satisfy security and regulatory requirements in a gaming environment, hardware and software architectures are implemented in the gaming device 200 that may differ from those of general-purpose computers. Adapting general purpose computers to function as gaming devices 200 may not be simple or straightforward because of: (1) the regulatory requirements for the gaming device 200, (2) the harsh environment in which the gaming device 200 operate, (3) security requirements, (4) fault tolerance requirements, and (5) the requirement for additional special purpose componentry enabling functionality of an EGM. These differences require substantial engineering effort with respect to game design implementation, game mechanics, hardware components, and software. 25

One regulatory requirement for games running on the gaming device 200 generally involves complying with a certain level of randomness. Gaming jurisdictions may mandate that gaming devices satisfy a minimum level of randomness without specifying how a gaming device should achieve this level of randomness. To comply, FIG. 2A illustrates that the gaming device 200 may include a random number generator (RNG) 212 that utilizes hardware and/or software to generate RNG outcomes that lack any pattern. The RNG operations may be specialized and non-generic in order to comply with regulatory and gaming requirements. For example, in a slot game, the game program 206 may initiate multiple RNG calls to RNG 212 to generate RNG outcomes, where each RNG call and RNG outcome corresponds to an outcome for a reel. In another example, the gaming device 200 may be a Class 2 gaming device where the RNG 212 generates RNG outcomes for creating bingo cards. In one or more implementations, the RNG 212 could be one of a set of RNGs operating on the gaming device 200. More generally, an output of the RNG 212 may be the basis 30



on which game outcomes are determined by the game controller **202**. Game developers could vary the degree of true randomness for each RNG (e.g., pseudorandom) and utilize specific RNGs depending on game requirements. The output of the RNG **212** may include a random number or pseudorandom number (either is generally referred to as a “random number”).

In FIG. 2A, the RNG **212** and a hardware RNG **244** are shown in dashed lines to illustrate that the RNG **212**, the hardware RNG **244**, or both, may be included in the gaming device **200**. In some implementations, instead of including the RNG **212**, the gaming device **200** may include a hardware RNG **244** that generates RNG outcomes. Analogous to the RNG **212**, the hardware RNG **244** may perform specialized and non-generic operations in order to comply with regulatory and gaming requirements. For example, because of regulation requirements, the hardware RNG **244** may be a random number generator that securely produces random numbers for cryptography use. The gaming device **200** may then use the secure random numbers to generate game outcomes for one or more game features. In additional or alternative implementations, the gaming device **200** may include both the hardware RNG **244** and the RNG **212**. The RNG **212** may additionally or alternatively utilize the RNG outcomes from the hardware RNG **244** as one of many sources of entropy for generating secure random numbers for the game features.

Another regulatory requirement for running games on the gaming device **200** includes ensuring a certain level of Return to Player (RTP) payouts. Similar to the randomness requirement discussed above, numerous gaming jurisdictions may also mandate that a gaming device provides a minimum level of RTP (e.g., RTP of at least 75%). A game may use one or more lookup tables (also called weighted tables) as part of a technical solution that satisfies regulatory requirements for randomness and RTP. In particular, a lookup table may integrate game features (e.g., trigger events for special modes or bonus games; newly introduced game elements such as extra reels, new symbols, or new cards; stop positions for dynamic game elements such as spinning reels, spinning wheels, or shifting reels; or card selections from a deck) with random numbers generated by one or more RNGs, so as to achieve a given level of volatility for a target level of RTP. (In general, volatility refers to the frequency or probability of an event such as a special mode, payout, etc. For example, for a target level of RTP, a higher-volatility game may have a lower payout most of the time with an occasional bonus having a very high payout, while a lower-volatility game has a steadier payout with more frequent bonuses of smaller amounts.) Configuring a lookup table may involve engineering decisions with respect to how RNG outcomes are mapped to game outcomes for a given game feature, while still satisfying regulatory requirements for RTP. Configuring a lookup table may also involve engineering decisions about whether different game features are combined in a given entry of the lookup table or split between different entries (for the respective game features), while still satisfying regulatory requirements for RTP and allowing for varying levels of game volatility.

FIG. 2A illustrates that the gaming device **200** includes a RNG conversion engine **210** that translates the RNG outcome from the RNG **212** to a game outcome presented to a player. To meet a designated RTP, a game developer may set up the RNG conversion engine **210** to utilize one or more lookup tables to translate the RNG outcome to a symbol element, stop position on a reel strip layout, and/or randomly

chosen aspect of a game feature. As an example, the lookup tables may regulate a prize payout amount for each RNG outcome and how often the gaming device **200** pays out the prize payout amounts. The RNG conversion engine **210** may utilize one lookup table to map the RNG outcome to a game outcome displayed to a player and a second lookup table as a pay table for determining the prize payout amount for each game outcome. The mapping between the RNG outcome to the game outcome may partially or entirely control the frequency in hitting certain prize payout amounts.

FIG. 2A also depicts that the gaming device **200** is connected over network **214** to a player tracking system server **110**. The player tracking system server **110** may be, for example, an OASIS® system manufactured by Aristocrat® Technologies, Inc. The player tracking system server **110** may be used to track play (e.g. amount wagered, games played, time of play and/or other quantitative or qualitative measures) for individual players so that an operator may reward players in a loyalty program. The player may use the player tracking interface **232** to access his/her account information, activate free play, and/or request various information. Player tracking or loyalty programs may reward players for their play and may help build brand loyalty to the gaming establishment. The rewards typically correspond to the player’s level of patronage (e.g., to the player’s playing frequency and/or total amount of gameplays at a given casino). Player tracking rewards may be complimentary and/or discounted meals, lodging, entertainment and/or additional play. Player tracking information may be combined with other information that may be readily obtainable by a casino management system.

When a player wishes to play the gaming device **200**, he/she may insert cash or a ticket voucher through a coin acceptor (not shown) or bill validator **234** to establish a credit balance on the gaming device. The credit balance may be used by the player to place wagers on instances of the game and to receive credit awards based on the outcome of winning instances. The credit balance may be decreased by the amount of each wager and may be increased upon a win. The player may add additional credits to the balance at any time. The player may also optionally insert a loyalty club card into the card reader **230**. During the game, the player may view, with one or more user interfaces (UIs), the game outcome on one or more of the primary game display **240** and secondary game display **242**. Other game and prize information may also be displayed.

For each game instance, a player may make selections, which may affect play of the game. For example, the player may vary the total amount wagered by selecting the amount bet per line and the number of lines played. In some games, the player may be asked to initiate or select options during course of gameplay (such as spinning a wheel to begin a bonus round or select various items during a feature game). The player may make these selections using the player-input buttons **236**, the primary game display **240** which may be a touch screen, or using another device which enables a player to input information into the gaming device **200**.

During certain game events, the gaming device **200** may display visual and auditory effects that may be perceived by the player. These effects may add to the excitement of a game, which may make a player more likely to enjoy the playing experience. Auditory effects include various sounds that are projected by the speakers **220**. Visual effects include flashing lights, strobing lights or other patterns displayed from lights on the gaming device **200** or from lights behind the information panel **152** (see FIG. 1).



When the player is done, he/she may cash out the credit balance (typically by pressing a cash out button to receive a ticket from the ticket printer **222**). The ticket may be “cashed-in” for money or inserted into another machine to establish a credit balance for play.

Additionally, or alternatively, gaming devices **104A-104X** and **200** may include or be coupled to one or more wireless transmitters, receivers, and/or transceivers (not shown in FIGS. **1** and **2A**) that communicate (e.g., Bluetooth® or other near-field communication technology) with one or more mobile devices to perform a variety of wireless operations in a casino environment. Examples of wireless operations in a casino environment may include detecting the presence of mobile devices; performing credit, points, comps, or other marketing or hard currency transfers; establishing wagering sessions; providing a personalized casino-based experience using a mobile application; and so on. In some implementations, to perform these wireless operations, a wireless transmitter or transceiver may initiate a secure wireless connection between a gaming devices **104A-104X** and/or **200** and a mobile device. After establishing a secure wireless connection between the gaming devices **104A-104X** and/or **200** and the mobile device, the wireless transmitter or transceiver may not send and/or receive application data to and/or from the mobile device. Rather, the mobile device communicates with gaming devices **104A-104X** and/or **200** may use another wireless connection (e.g., WiFi® or cellular network). In alternative or additional implementations, a wireless transceiver may establish a secure connection to directly communicate with the mobile device. The mobile device and gaming device **104A-104X** and/or **200** may send and receive data utilizing the wireless transceiver instead of utilizing an external network. For example, the mobile device may perform digital wallet transactions by directly communicating with the wireless transceiver. In some implementations, a wireless transmitter could broadcast data received by one or more mobile devices without establishing a pairing connection with the mobile devices.

Although FIGS. **1** and **2A** illustrate specific implementations of a gaming device (e.g., gaming devices **104A-104X** and/or **200**), the disclosure is not limited to those implementations shown in FIGS. **1** and **2**. For example, not all gaming devices suitable for implementing implementations of the present disclosure necessarily include top wheels, top boxes, information panels, cashless ticket systems, and/or player tracking systems. Further, some suitable gaming devices may only have a single game display that includes only a mechanical set of reels and/or a video display, while others may be designed for bar counters or tabletops and have displays that face upwards. Gaming devices **104A-104X** and **200** may also include other processors that are not separately shown. Using FIG. **2A** as an example, a gaming device **200** may include display controllers (such as a game pad, keyboard, or button-based input, not shown in FIG. **2A**) configured to receive video input signals or instructions to display images on game displays **240** and **242**. Alternatively, such display controllers may be integrated into the game controller **202**. The use and discussion of FIGS. **1** and **2** are examples to facilitate ease of description and explanation.

FIG. **2B** depicts a casino gaming environment according to one example. In this example, the casino **251** may include banks **252** of EGMs **104**. In this example, each bank **252** of EGMs **104** may include a corresponding gaming signage system **254** (also shown in FIG. **2A**). According to this implementation, the casino **251** may also include mobile gaming devices **256**, which are also configured to present wagering games in this example. The mobile gaming

devices **256** may, for example, include tablet devices, cellular phones, smart phones and/or other handheld devices. In this example, the mobile gaming devices **256** may be configured for communication with one or more other devices in the casino **251**, including but not limited to one or more of the server computers **102**, via wireless access points **258**.

According to some examples, the mobile gaming devices **256** may be configured for stand-alone determination of game outcomes. However in additional or alternative implementations, the mobile gaming devices **256** may be configured to receive game outcomes from another device, such as the central determination gaming system server **106**, one of the EGMs **104**, and so on.

Some mobile gaming devices **256** may be configured to accept monetary credits from a credit or debit card, via a wireless interface (e.g., via a wireless payment app), tickets, a patron casino account, and so on. However, some mobile gaming devices **256** may not be configured to accept monetary credits via a credit or debit card. Some mobile gaming devices **256** may include a ticket reader and/or a ticket printer whereas some mobile gaming devices **256** may not, depending on the particular implementation.

In some implementations, the casino **251** may include one or more kiosks **260** that are configured to facilitate monetary transactions involving the mobile gaming devices **256**, which may include cash-out and/or cash-in transactions. The kiosks **260** may be configured for wired and/or wireless communication with the mobile gaming devices **256**. The kiosks **260** may be configured to accept monetary credits from casino patrons **262** and/or to dispense monetary credits to casino patrons **262** via cash, a credit or debit card, a wireless interface (e.g., a wireless payment app), tickets, and so on. According to some examples, the kiosks **260** may be configured to accept monetary credits from a casino patron and may provide a corresponding amount of monetary credits to a mobile gaming device **256** for wagering purposes, e.g., via a wireless link such as a near-field communications link. In some such examples, when a casino patron **262** is ready to cash out, the casino patron **262** may select a cash out option provided by a mobile gaming device **256**, which may include a real button or a virtual button (e.g., a button provided via a graphical user interface) in some instances. In some such examples, the mobile gaming device **256** may send a “cash out” signal to a kiosk **260** via a wireless link in response to receiving a “cash out” indication from a casino patron. The kiosk **260** may provide monetary credits to the casino patron **262** corresponding to the “cash out” signal, which may be in the form of cash, a credit ticket, a credit transmitted to a financial account corresponding to the casino patron, and so on.

In some implementations, a cash-in process and/or a cash-out process may be facilitated by the TITO system server **108**. For example, the TITO system server **108** may control, or at least authorize, ticket-in and ticket-out transactions that involve a mobile gaming device **256** and/or a kiosk **260**.

Some mobile gaming devices **256** may be configured for receiving and/or transmitting player loyalty information. For example, some mobile gaming devices **256** may be configured for wireless communication with the player tracking system server **110**. Some mobile gaming devices **256** may be configured for receiving and/or transmitting player loyalty information via wireless communication with a patron’s player loyalty card, a patron’s smartphone, etc.

According to some implementations, a mobile gaming device **256** may be configured to provide safeguards that



prevent the mobile gaming device **256** from being used by an unauthorized person. For example, some mobile gaming devices **256** may include one or more biometric sensors and may be configured to receive input via the biometric sensor(s) to verify the identity of an authorized patron. Some mobile gaming devices **256** may be configured to function only within a predetermined or configurable area, such as a casino gaming area.

FIG. **2C** is a diagram that shows examples of components of a system for providing online gaming according to some aspects of the present disclosure. As with other figures presented in this disclosure, the numbers, types and arrangements of gaming devices shown in FIG. **2C** are merely shown by way of example. In this example, various gaming devices, including but not limited to end user devices (EUDs) **264a**, **264b** and **264c** may be capable of communication via one or more networks **417**. The networks **417** may, for example, include one or more cellular telephone networks, the Internet, and so on. In this example, the EUDs **264a** and **264b** are mobile devices: where the EUD **264a** is a tablet device and the EUD **264b** is a smart phone. In this implementation, the EUD **264c** is a laptop computer that is located within a residence **266** at the time depicted in FIG. **2C**. Accordingly, in this example the hardware of EUDs is not specifically configured for online gaming, although each EUD is configured with software for online gaming. For example, each EUD may be configured with a web browser. Other implementations may include other types of EUD, some of which may be specifically configured for online gaming.

In this example, a gaming data center **276** may include various devices that are configured to provide online wagering games via the networks **417**. The gaming data center **276** may be capable of communication with the networks **417** via the gateway **272**. In this example, switches **278** and routers **280** may be configured to provide network connectivity for devices of the gaming data center **276**, including storage devices **282a**, servers **284a**, and one or more workstations **286a**. The servers **284a** may, for example, be configured to provide access to a library of games for online gameplay. In some examples, code for executing at least some of the games may initially be stored on one or more of the storage devices **282a**. The code may be subsequently loaded onto a server **284a** after selection by a player via an EUD and communication of that selection from the EUD via the networks **417**. The server **284a** onto which code for the selected game has been loaded may provide the game according to selections made by a player and indicated via the player's EUD. In other examples, code for executing at least some of the games may initially be stored on one or more of the servers **284a**. Although only one gaming data center **276** is shown in FIG. **2C**, some implementations may include multiple gaming data centers **276**.

In this example, a financial institution data center **270** is also configured for communication via the networks **417**. Here, the financial institution data center **270** may include servers **284b**, storage devices **282b**, and one or more workstations **286b**. According to this example, the financial institution data center **270** may be configured to maintain financial accounts, such as checking accounts, savings accounts, loan accounts, and so on. In some implementations, one or more of the authorized users **274a-274c** may maintain at least one financial account with the financial institution that is serviced via the financial institution data center **270**.

According to some implementations, the gaming data center **276** may be configured to provide online wagering

games in which money may be won or lost. According to some such implementations, one or more of the servers **284a** may be configured to monitor player credit balances, which may be expressed in game credits, in currency units, or in any other appropriate manner. In some implementations, the server(s) **284a** may be configured to obtain financial credits from and/or provide financial credits to one or more financial institutions, according to a player's "cash in" selections, wagering game results, and a player's "cash out" instructions. According to some such implementations, the server(s) **284a** may be configured to electronically credit or debit the account of a player that is maintained by a financial institution, e.g., an account that is maintained via the financial institution data center **270**. The server(s) **284a** may, in some examples, be configured to maintain an audit record of such transactions.

In some alternative implementations, the gaming data center **276** may be configured to provide online wagering games for which credits may not be exchanged for cash or the equivalent. In some such examples, players may purchase game credits for online gameplay, but may not "cash out" for monetary credit after a gaming session. Moreover, although the financial institution data center **270** and the gaming data center **276** include their own servers and storage devices in this example, in some examples the financial institution data center **270** and/or the gaming data center **276** may use offsite "cloud-based" servers and/or storage devices. In some alternative examples, the financial institution data center **270** and/or the gaming data center **276** may rely entirely on cloud-based servers.

One or more types of devices in the gaming data center **276** (or elsewhere) may be capable of executing middleware, e.g., for data management and/or device communication. Authentication information, player tracking information, etc., including but not limited to information obtained by EUDs **264** and/or other information regarding authorized users of EUDs **264** (including but not limited to the authorized users **274a-274c**), may be stored on storage devices **282** and/or servers **284**. Other game-related information and/or software, such as information and/or software relating to leaderboards, players currently playing a game, game themes, game-related promotions, game competitions, etc., also may be stored on storage devices **282** and/or servers **284**. In some implementations, some such game-related software may be available as applications ("apps") and may be downloadable (e.g., from the gaming data center **276**) by authorized users.

In some examples, authorized users and/or entities (such as representatives of gaming regulatory authorities) may obtain gaming-related information via the gaming data center **276**. One or more other devices (such as EUDs **264** or devices of the gaming data center **276**) may act as intermediaries for such data feeds. Such devices may, for example, be capable of applying data filtering algorithms, executing data summary and/or analysis software, etc. In some implementations, data filtering, summary and/or analysis software may be available as "apps" and downloadable by authorized users.

FIGS. **3A** and **3B** illustrate an example gaming device **300** (e.g., an EGM) that includes a display panel **328** with two planar display regions, a first planar display region **328A** and a second planar display region **328B**. As discussed and shown with respect to FIG. **3B**, each of the planar display regions may be offset by an offset angle  $\theta_1$  and may be presented differently (e.g., at different viewing angles) to a player of the gaming device **300**. Due to the offset angle  $\theta_1$  between the first planar display region **328A** and the second



planar display region **328B**, the two planar display regions may simulate multiple, discrete displays.

In the provided figures, the offset angle  $\theta_1$  is set to  $90^\circ$ , though in other cases the offset angle  $\theta_1$  may be set to any other value. It is additionally noted that the offset angle  $\theta_1$  is formed as a right angle (e.g., with a hard edge) as it appears in FIGS. **3A** and **3B**. However, in some cases, the offset angle  $\theta_1$  is smoothed, rounded or otherwise softened so that a transition between the first planar display region **328A** and the second planar display region **328B** is made more gradual.

The gaming device **300** may be similar to the gaming devices discussed herein (e.g., gaming devices **104A-104X**) and the visual appearance of the gaming device **300** is not limited to that depicted in FIG. **3A**. The gaming device **300** may include a main cabinet **316** and a display assembly **350**. In some cases, the main cabinet **316** may be detachably coupled with the display assembly **350**.

The main cabinet **316** may act as a main housing and may include a main door, and/or a main access panel, which provides access to the interior of the main cabinet **316**. The interior of the main cabinet **316** may include various electronic components such as, for example, machinery/materials for printing/accepting tickets, components for scanning tickets and/or cards, a game controller, a power supply, and so on (see, e.g., discussion surrounding FIG. **1**). The main cabinet **316** may be detachably coupled with a display assembly **350**, such as described with respect to FIGS. **9A-9B**. That is, the main cabinet **316** may be provided on a floor (e.g., a casino floor) and the display assembly **350** may be removed after being released from the main cabinet **316**. In some cases, the display assembly **350** is integrated with the main cabinet **316** such that the display assembly **350** is not removable from the main cabinet **316**.

The display assembly **350** may include a display panel **328**, a housing for the display panel **328**, and one or more mechanical and/or electrical components to couple with the main cabinet **316** (see, e.g., FIGS. **9A-9B**). The display panel **328** may be a single display (e.g., an LCD or LED display) that includes a transition region **329** between a first planar display region **328A** and a second planar display region **328B**. As shown in FIG. **3B**, the first planar display region **328A** may be offset by an offset angle  $\theta_1$  with respect to the second planar display region **328B**. The housing for the display panel **328** may be referenced as a display assembly housing and may at least partially surround the display panel **328**. A rear surface of the display assembly housing may include an electrical connector (see, e.g., first electrical connector **951** depicted in FIG. **9A**) and/or multiple attachment mechanisms (e.g., the first and second side attachment mechanisms **953A/953B** as depicted in FIG. **9A**).

Moving back to FIG. **3A**, the transition region **329** may define a boundary between the first planar display region **328A** and the second planar display region **328B**. In some cases, the transition region **329** remains as a part of the display panel **328** (e.g., the display panel **328** is bent at the transition region **329**). In some cases, the transition region **329** is configured to display a black/white/colored bar (e.g., activated or un-activated pixels) with a thickness between 1-600 pixels, and/or between 100-200 pixels. In some cases, the transition region **329** has a width of 180 pixels. In some cases, the transition region **329** displays images, graphics, and/or illuminated pixels so as to emit light from the transition region **329**. In some cases, only a portion of the transition region **329** (e.g., an outside portion) is illuminated

so as to connect the first planar display region **328A** with the second planar display region **328B**.

As depicted in FIGS. **3A** and **3B**, the planar display regions may be facing different directions. For example, the first planar display region **328A** is positioned substantially vertically, with respect to a ground surface, and the second planar display region **328B** is positioned substantially horizontally, with respect to ground, such that an offset angle  $\theta_1$  is set at  $90^\circ$ . In this way and continuing the above example, the second planar display region **328B** and the first planar display region **328A** are perpendicular with respect to each other.

Though an offset angle  $\theta_1$  of  $90^\circ$  is discussed, any offset angle  $\theta_1$  may be used in accordance with the provided disclosure. For example, an offset angle  $\theta_1$  of  $45^\circ$ ,  $35^\circ$ ,  $15^\circ$ ,  $25^\circ$ , and so on may be used in accordance with the provided disclosure.

The two planar display regions may display identical UIs (e.g., a duplicated UI), may display different UIs, or may display an extended UI (e.g., a UI which extends across the first planar display region **328A** and the second planar display region **328B**). In cases where the two planar display regions display different UIs, each UI may be provided for a different purpose. For example, the first planar display region **328A** displays various animations related to, for example, a number of cards being drawn, a video pachinko game play animation, a video black jack dealer, a spinning roulette wheel, and so on. The second planar display region **328B** displays menus, input options, and so on, configured to receive a player input. For example, the second planar display region **328B** displays a keno card, a hand of cards associated with the player, options to select certain numbers/colors for a roulette wheel, and so on. In additional or alternative examples, the second planar display region **428B** is a virtual button deck that presents and/or is connected to multiple bet buttons and one or more spin buttons. Though particular UIs are discussed with respect to particular planar display regions, it is noted that any UI may be provided on any planar display region in accordance with the design principles of any particular game.

In some cases, the second planar display region **328B** is a touch-sensitive display and the first planar display region **328A** is not configured to receive touch inputs. For example, an additional layer configured to detect touch and/or force inputs is created over the second planar display region **328B**. This layer may be any single layer or any combination of multiple layers including, for example, a drive layer, a compliant layer, and a sensor layer. Any type of touch sensing, including resistive touch sensing, surface capacitive sensing, projected capacitance sensing, and so on, may be used. In alternative cases, both the first planar display region **328A** and the second planar display region **328B** are touch-sensitive or neither of the planar display regions are touch-sensitive.

In some cases, as depicted in FIGS. **3A** and **3B**, the first planar display region **328A** are substantially perpendicular/vertical to a mounting surface of the gaming device **300** and/or are substantially perpendicular/vertical with respect to a viewing angle of a player of the gaming device **300**. In addition, the second planar display region **328B** may be substantially horizontal/perpendicular with respect to the first planar display region **328A**. In some cases, the angle of any one of the first planar display region **328A** and the second planar display region **328B** is set to any value.

Any size or resolution of a display panel **328** may be used. In some examples, the display panel **328** is a 43-inch display with a 4 k resolution (e.g., a horizontal resolution of about



4,000 pixels). In some cases, the planar display regions comprise the same resolution. For example, the first planar display region **328A** has a resolution of 1920×1080 and the second planar display region **328B** also has a resolution of 1920×1080, though these are merely examples and any resolution may be used. In some cases, the first planar display region **328A** and the second planar display region **328B** have different resolutions. In FIGS. **3A** and **3B**, the first planar display region **328A** is approximately twice the size of the second planar display region **328B**, though this is merely an example and any size of either planar display region may be used.

A display panel **328** may include any type of display including a liquid-crystal display (LCD), an organic light-emitting diode (OLED) display, a light-emitting diode (LED) display, and so on. In some cases, the display panel **328** may be configured to modify a brightness based on electrical signals modified by a controller.

FIG. **4A** illustrates an example gaming device **400** (e.g., an EGM) including a display panel **428** with a first planar display region **428A**, a second planar display region **428B**, and a third planar display region **428C**. The gaming device **400** may be similar to the gaming device **300** described and depicted with reference to FIGS. **3A** and **3B** and duplicative descriptions may be omitted or reduced. Further, the gaming device **400** may be similar to the gaming devices discussed herein (e.g., gaming devices **104A-104X**).

The gaming device **400** may include a main cabinet **416** coupled with a display assembly **450**. The display assembly may include a display panel **428**, a housing for the display panel **428**, and one or more mechanical and/or electrical components to couple with the main cabinet **416**. In some cases, the main cabinet **416** is substantially similar to the main cabinet **316**. In alternate cases, the main cabinet **416** has a different form to account for the differently shaped display assembly **450**. The main cabinet **416** may include all electronic/internal components as discussed herein such as, for example, a game controller.

As depicted in FIG. **4B**, each planar display region may be offset by a respective offset angle with respect to a neighboring planar display region. For example, a first planar display region **428A** is offset from a second planar display region **428B** by a first offset angle  $\theta_2$ . Similarly, the first planar display region **428A** is offset from a third planar display region **428C** by a second offset angle  $\theta_3$ . As depicted, the first offset angle  $\theta_2$  is set to 135° and the second offset angle is set to 45°, though these values are merely provided for explanatory purposes. In some cases, the first offset angle  $\theta_2$  and the second offset angle  $\theta_3$  are equivalent (e.g., 45°) or are set to any value. This arrangement may simulate the presence of three discrete displays using only the display panel **428**. In alternative cases, the offset angles may be set to different values. As described with respect to FIGS. **3A** and **3B**, the particular value of any respective offset angle is not limited to any particular embodiment.

In some cases, the third planar display region **428C** acts as an informational UI and displays graphics and/or animations relating to, for example, the name of the game running on the gaming device **400** (see, e.g., FIG. **8**), though it is noted that any UI may be provided on any of the planar display regions including, but not limited to, extended or duplicate displays. In some cases, the second planar display region **428B** is horizontal, with respect to ground, and the third planar display region **428C** is vertical with respect to ground, though these are merely examples.

Moving back to FIG. **4A**, the gaming device **400** may additionally comprise a first transition region **429A** and a

second transition region **429B**. As discussed above, the transition regions may correspond to a transition between neighboring planar display regions and may be bent at an offset angle. The bent transition regions may be substantially equivalent in width and/or length (e.g., 180 pixels wide) or may have different widths and/or lengths depending on a degree of a bend. As discussed above, the transition regions may comprise turned-off pixels (e.g., dark pixels), illuminated pixels, or any combination thereof. The first transition region **429A** and the second transition region **429B** may comprise sharp edges or may be rounded, as described with respect to FIGS. **3A** and **3B**.

With respect to FIGS. **3A-4B**, the multiple planar display regions may be designed to be viewable by a single player at different angles. However, the provided disclosure is not limited to this arrangement. As discussed below in FIGS. **5A-6**, multiple planar display regions may be provided and may be configured to display graphical elements to more than one player and/or associated persons. In some cases, a player is not be able to view every provided planar display region at one time and some planar display regions are hidden from the player. In such cases, multiple players and/or associated persons each view different planar display regions if viewing the gaming device from different vantage points. This may be beneficial in, for example, competitive games where two or more players are pitted against each other. Continuing the above example, each individual player is prevented from viewing some planar display regions to avoid obtaining a competitive advantage over another player.

FIGS. **5A** and **5B** illustrate an example gaming device **500** (e.g., an EGM) that includes display regions viewable from different positions relative to the gaming device. As illustrated, the gaming device **500** includes planar display regions **528A**, **528B**, and **528C**, with consecutive display regions separated by a respective transition region (e.g., a first transition region **529A** and a second transition region **529B**). The gaming device **500** may be configured so that two planar display regions (e.g., planar display regions **528A** and **528B**) face, or partially face, a first direction and another planar display region (e.g., planar display region **528C**, see FIG. **5B**) faces, or partially faces, an opposite direction. In this way, two planar display regions may face a player of the gaming device **500** and one planar display region may face an operator or attendant. For example, if the gaming device **500** were installed on a bar- or table-top, the two planar display regions **528A** and **528B** face a player and one planar display region **528C** faces away from the player (so that an operator or attendant may, for example, navigate a menu). Similar to the examples discussed above with respect to FIGS. **3A-4B**, the display panel **528** may comprise one uniform display and may comprise multiple planar display regions, each planar display region separated from a consecutive planar display region by a bent transition region. Likewise, the gaming device **500** may include a display assembly **550** and a game cabinet **516**. In some cases, the gaming device is made smaller so as to fit on a table or bar. In some embodiments, the first planar display region **528A** is offset from the second planar display region **528B** by a 45° offset angle  $\theta_4$ , though  $\theta_4$  may be set to any value. An offset angle  $\theta_5$  may be set above 180°, such that the first planar display region **528A** and the third planar display region **528C** generally face opposite directions, though  $\theta_5$  may be manufactured at any value.

FIG. **6** illustrates an example gaming device **600** (e.g., an EGM) that includes display regions viewable from different positions relative to the gaming device. The gaming device



600 may include a game cabinet 616, a display assembly 650, and a display panel that includes four planar display regions, as described herein. Two of the planar display regions may face one direction and the remaining two of the planar display regions may face an opposite direction. This may permit a head-to-head game where two players can each view two planar display regions without viewing the other planar display regions. As described above, the planar display regions may be offset by various offset angles  $\theta_6$ ,  $\theta_7$ , and  $\theta_8$ , which may be set to any value such as, in the case of offset angles  $\theta_6$  and  $\theta_8$ ,  $45^\circ$  or, in the case of  $\theta_7$ , greater than  $180^\circ$ . Other features of gaming device 600 may be similar to those discussed with respect to FIGS. 1-5B.

FIGS. 7A-7C illustrate an example gaming device 700 including a display panel 728 and glass cover sheet 727 that defines a raised perimeter region 731. The gaming device 700 may be similar to the gaming devices discussed herein (e.g., gaming devices 104A-104X) and the visual appearance of the gaming device 700 is not limited to that depicted in FIG. 7A. Though FIG. 7A depicts three planar display regions, any number of planar display regions may be provided.

As depicted in FIG. 7A, the raised perimeter region 731 is raised compared to an inner region of the glass cover sheet 727 and surrounds a perimeter of the display panel 728. A height of the raised perimeter region 731 is not particularly limited and may be between 1 mm and 500 mm, be between 20 mm and 100 mm, and/or may be above 500 mm. As further depicted in FIG. 7A, each of the planar display regions 728A-728C may have a respective portion of their periphery surrounded by the raised perimeter region 731 such that the raised perimeter region 731 surrounds the inner region of the display panel 728. For example, the second planar display region 728B and the third planar display region 728C are surrounded on three sides by the raised perimeter region 731 and the first planar display region 728A are surrounded on two sides by the raised perimeter region 731.

As can be seen in FIG. 7C, the glass cover sheet 727 may have a substantially uniform thickness across a width of the glass cover sheet 727, but the raised perimeter region 731 may be raised relative to an inner region 725. The raised perimeter region 731 may allow various elements (e.g., a light pipe 739 and/or a gasket 741) to be disposed underneath the raised perimeter region 731, as discussed herein.

FIG. 7B illustrates a perspective view of a display with a raised perimeter region 731. As can be seen in FIG. 7B, the raised perimeter region 731 may surround the perimeter of the display panel 728. In alternative examples, a raised perimeter region surrounds each individual planar display region 728A-728C, though this is not depicted in FIG. 7A or 7B. The raised perimeter region 731 may act to keep liquid, or other objects, spilled on the glass cover sheet 727 contained within the glass cover sheet 727 so as to not damage electronic components as may be disposed on an associated main cabinet.

As depicted in FIG. 7C, the display assembly may include optical and/or other components beneath the raised perimeter region 731 of the glass cover sheet 727. The view in FIG. 7C is cut along line A-A as depicted in FIG. 7B. FIG. 7C illustrates a display assembly that includes a base layer 733, a backlight 735, a display 737, a light pipe 739, a gasket 741, and a glass cover sheet 727. The base layer 733 may be any layer acting as a casing/housing and may be formed of metal, plastic, glass, laminate, and so on. A backlight 735 may be coupled to the base layer 733 and may be configured to emit light toward the display 737. In some cases, and/or

with certain types of display, the backlight 735 is omitted. The backlight 735 may be controlled (e.g., by a controller) to provide variable levels of display brightness which may be measured in lumens or nits. In some cases, the backlight 735 is non-uniform such that, for example, the raised perimeter region 731 is illuminated at a higher brightness than surrounding regions.

A display 737 may be any type of display including a liquid-crystal display (LCD), an organic light-emitting diode (OLED) display, a light-emitting diode (LED) display, and so on. In some cases, the display 737 is configured to modify a brightness, without the use of a backlight 735, based on electrical signals modified by a controller. As described herein, the display 737 may comprise multiple planar display regions separated by one or more bent transition regions.

A light pipe 739 may further be coupled on the display 737 at a perimeter surrounding the display. The light pipe 739 may include any optical elements configured to diffuse or otherwise manipulate light and may be transparent, or partially transparent. The light pipe 739 may diffuse, or blur, light emitted from the display 737 and/or backlight 735 which may result in providing a smoothed or blurred graphical output to a player. In this way, the portion of the display 737 beneath the raised perimeter region 731 may be perceived differently than a region of the display 737 beneath the inner region 725. A gasket 741 may further be positioned on top of the light pipe 739. The gasket 741 may be formed of a rubber, plastic, or other material and may be configured to protect the edge of a glass cover sheet 727 from impacts and/or breaks. The gasket 741 may be, for example, a circular gasket and may surround the perimeter of the display stack-up.

As described herein, a glass cover sheet 727 may be positioned on top of the gasket 741 (e.g., within the raised perimeter region 731) and/or on top of the display 737 (e.g., outside of the raised perimeter region 731). The glass cover sheet 727 may be any transparent, or partially transparent, material (including, but not limited to, glass) and may protect the display 737 from impacts and/or damage. The raised perimeter region 731 may be configured to strengthen the glass cover sheet 727 and may absorb, or otherwise mitigate, any potential damage from careless players or other environmental factors.

FIG. 8 illustrates an example gaming device 800 including edge lighting and display outputs. A main cabinet 816 may be substantially similar to main cabinets described herein. As described with respect to FIGS. 7A-7C, a raised perimeter region 831 may be provided to surround a perimeter of a display panel 828. During the course of gameplay, certain game elements may be provided on the display panel 828, as controlled by a game controller. For example, a game board may be provided on a second planar display region 828B, a graphic may be provided on a first planar display region 828A, and a title or game advertisement may be provided on a third planar display region 828C. Continuing the above example, edge lighting may surround each of the display regions to emphasize certain areas or to draw a player's attention to the gaming device. As the edge lighting (corresponding to the raised perimeter region 831) is lit from a common display, the game controller may treat an edge portion differently to display specialized colors, graphics, and/or animations. The displayed portions corresponding to the raised perimeter region 831 may further be blurred or smoothed by, for example, a light pipe to further visually distinguish the edge region. In some cases, the raised



perimeter region may correspond to a 100-pixel width of the display, though any width of the raised perimeter region may be used.

As the edge lighting is emitted by a common display (e.g., display panel **828**) and is controlled by a controller, the need for separate LEDs and/or LED strips to produce an edge lighting effect may be eliminated. In this way, the game controller may control the portion of the display panel **828** that is directly underneath the raised perimeter region **831** differently than the portions of the display panel **828** that are internal with respect to the raised perimeter region **831**.

FIGS. **9A** and **9B** depict an example display assembly **950** and an example main cabinet **916** comprising an electrical connector (e.g., a first electrical connector and a second electrical connector) and an attachment mechanism (e.g., a first attachment mechanism and a second attachment mechanism). The display assembly **950** depicted in FIG. **9A** is detached from the main cabinet **916** and FIG. **9B** depicts the display assembly **950** and the main cabinet **916** in an attached state.

With respect to FIG. **9A**, a display assembly **950** may include a first electrical connector **951**, a first attachment mechanism **949**, a first side attachment mechanism **953A**, and a second side attachment mechanism **953B**. As used herein, the first and second side attachment mechanisms **953A** and **953B** may include paddles for connecting with the main cabinet **916**. The display assembly **950** may interface, as discussed herein, with various locations on a main cabinet **916**. The main cabinet **916** may include a second electrical connector **917**, a second attachment mechanism **913**, a first side cabinet attachment mechanism **919A**, a second side cabinet attachment mechanism **919B**, and a locking mechanism **915**. The first side cabinet attachment mechanism **919A** and the second side cabinet attachment mechanism **919B** may comprise receiving elements that receive the first side attachment mechanism **953A** and the second side attachment mechanism **953B**.

The two electrical connectors (e.g., electrical connectors **951** and **917**) may act as a pressure-based electrical contact system and may serve to electrically couple the display assembly **950** with the main cabinet **916**. In an example, a first electrical connector **951** disposed on the display assembly **950** is electrically coupled to the display and various electronic components positioned within the display assembly **950** (e.g., speakers and/or input devices). The first electrical connector **951** may include various spring-loaded pins each comprising, for example, a plunger, a barrel, and a spring. When the display assembly **950** is uncoupled from the main cabinet **916**, the first electrical connector **951** may have spring-loaded pins in an extended position as the spring, in an un-compressed state, extending the barrel outward. When the display assembly **950** is integrated with the main cabinet **916** (e.g., installed), the spring may be compressed by, for example, a normal force with the main cabinet **916**.

The first electrical connector **951** may be formed as a grid, or series of regions, each corresponding to a particular electronic engagement. In an example, the first electrical connector **951** includes engagements for multiple power connections (e.g., 5 volts, 12 volts, 24 volts, and ground), video in-or-out connections (e.g., a display connection, a digital visual interface (DVI) connection, a high-definition multimedia interface (HDMI) connection), a universal serial bus (USB) connection, an audio connection (e.g., digital or analog), and so on. In some cases, each particular engagement (e.g., an HDMI engagement) comprises multiple regions, or pins, from the first electrical connector **951**.

The second electrical connector **917** formed on the main cabinet **916** may include respective electronic engagements that correspond with the engagements on the first electrical connector **951**. In some examples, the first electrical connector **951** includes spring-loaded pins and the second electrical connector **917** includes a receiver configured to receive each spring-loaded pin, though, in some cases, this arrangement may be reversed (e.g., the second electrical connector **917** may comprise spring-loaded pins). In some cases, compressing the spring loaded pins from a contact with the second electrical connector **917** closes a circuit and results in electricity flowing through the first electrical connector **951** and the second electrical connector **917**. Though spring-loaded pins are discussed with respect to the electrical connectors, any pressure contact system for electrically coupling the display assembly **950** with the main cabinet **916** may be used.

In addition to the electrical connector (e.g., connectors **917** and **951**), various mechanical connectors may connect the main cabinet **916** with the display assembly **950**. For example, the display assembly **950** includes a first attachment mechanism **949** and the main cabinet **916** includes a second attachment mechanism **913**. As depicted in FIG. **9A**, the first attachment mechanism **949** is positioned on an external surface of the display assembly **950**, the external surface opposite from a surface defined by a glass cover sheet.

The first attachment mechanism **949** may be configured as a slot or port to receive a counterpart second attachment mechanism **913**. The first attachment mechanisms **949** may include springs or other biasing components configured to press against the second attachment mechanism **913** and may be attached, via internal cables, to one or both of a first side attachment mechanism **953A** or a second side attachment mechanism **953B**.

In an installed state, as depicted in FIG. **9B**, the display assembly **950** is attached with the main cabinet **916**. While in the installed state, the first side attachment mechanism **953A** may be coupled with the first side cabinet attachment mechanism **919A**, the second side attachment mechanism **953B** may be coupled with the second side cabinet attachment mechanism **919B**, and the first attachment mechanism **949** may be coupled with the second attachment mechanism **913**. As depicted in FIG. **9B**, the second attachment mechanism **913** is coupled to a locking mechanism **915** and transitions between two different states depending on whether the locking mechanism **915** is locked or unlocked. When locked, the display assembly **950** and the main cabinet **916** are securely fastened together such that removal of the display assembly **950** from the main cabinet **916** is prevented.

When the locking mechanism **915** is unlocked (e.g., by an operator), the second attachment mechanism **913** transitions to an unlocked state (e.g., by swiveling around a rotation axis) and becomes decoupled with the first attachment mechanism **949**. As described above, the first attachment mechanism **949** may include a biasing mechanism at an internal portion thereof and the biasing mechanism may apply a force to separate the display assembly **950** from the main cabinet **916**.

As the locking mechanism **915** is unlocked, cables linked with the first side cabinet attachment mechanism **919A** and the second side cabinet attachment mechanism **919B** may loosen, rotate, or cause rotation in any or both of the paddles, or may otherwise change a state to decouple with the respective paddles on the display assembly **950** (e.g., paddles **953A** and **953B**). In some cases, the locking mecha-



nism 915 only controls the first attachment mechanism 949 and the second attachment mechanism 913 without affecting the paddle mechanisms. Thereafter, when an operator grips the display assembly 950, the display assembly may be easily removable from the main cabinet 916. This may allow for quick replacement of any particular display assembly 950. Any number of brackets or structures (e.g., a rear wedge bracket) may be provided to ensure a connection between the display assembly 950 and the main cabinet 916.

The paddles and/or attachment mechanisms may also include various physical features (e.g., chamfers, slopes, planes, protrusions, wedges, and so on) to assist in the alignment between the display assembly 950 and the main cabinet 916. In some cases, a tactile and/or audible feedback (e.g., a snap sound or feeling) occurs when the display assembly 950 is properly installed with the main cabinet 916. In some cases, the display assembly 950 and the main cabinet 916 are only installed when the locking mechanism 915 is in an unlocked position and are “locked” into place when the locking mechanism 915 transitions to a locked position.

While the disclosure has been described with respect to the figures, it will be appreciated that many modifications and changes may be made by those skilled in the art without departing from the spirit of the disclosure. Any variation and derivation from the above description and figures are included in the scope of the present disclosure as defined by the claims. As used herein, including in the claims, “or” as used in a list of items prefaced by “at least one of” indicates a disjunctive list such that, for example, a list of “at least one of A, B, or C” means A or B or C or AB or AC or BC or ABC (i.e., A and B and C). Further, the term “exemplary” does not indicate that the described example is preferred or better than other examples.

What is claimed is:

1. A gaming device comprising:
  - a main cabinet;
  - a display assembly coupled to the main cabinet and comprising:
    - a display panel configured to provide graphical outputs;
    - a glass cover sheet positioned over the display panel and defining a raised perimeter region with respect to the display panel and to a portion of the glass cover sheet; and
  - a game controller positioned in the main cabinet and configured to:
    - control a game provided at the gaming device; and
    - drive a portion of display panel positioned under the raised perimeter region separately from remaining portions of the display panel to illuminate the raised perimeter region independently by providing edge lighting for the display assembly.
2. The gaming device of claim 1, wherein the display assembly further comprises:
  - a light pipe disposed underneath the glass cover sheet at the raised perimeter region, the light pipe configured to diffuse light from the portion of the display panel under the raised perimeter region towards the raised perimeter region; and
  - a gasket positioned between the light pipe and the glass cover sheet.
3. The gaming device of claim 1, wherein the portion of the display panel under the raised perimeter region has a width of about 100 pixels.

4. The gaming device of claim 1, wherein the display panel defines:

- a first planar display region; and
- a second planar display region offset from the first planar display region by an offset angle.

5. The gaming device of claim 4, wherein the game controller is further configured to:

- cause display of gameplay elements corresponding to the game on the first planar display region; and
- cause display of menu elements corresponding to the game on the second planar display region, the gameplay elements and the menu elements controlled independently of the edge lighting.

6. The gaming device of claim 5, wherein the edge lighting is illuminated with a particular color that is distinct from the gameplay elements and the menu elements.

7. The gaming device of claim 1, wherein the edge lighting comprises one or more animations configured to attract a user’s attention.

8. The gaming device of claim 1, wherein:
- the glass cover sheet has a uniform thickness and a first width; and
  - the display panel has a second width less than the first width.

9. A gaming device comprising:

- a display assembly comprising a display panel, the display panel defining a display output and an edge lighting output, the edge lighting output peripheral to the display output and configured to use a portion of display pixels from the display assembly as an edge light source;
- a glass cover sheet extending over the display panel, the glass cover sheet defining a raised perimeter region positioned at least partially over the edge lighting output of the display panel, the raised perimeter region raised with respect to the display panel and to a portion of the glass cover sheet;
- a display assembly housing at least partially surrounding the display panel; and
- a game controller communicatively coupled with the display panel and configured to independently drive display pixels from the display output and display pixels from the edge lighting output.

10. The gaming device of claim 9, further comprising a main cabinet comprising:

- a first mechanical connector positioned along a front surface of the main cabinet; and
- a first electrical connector positioned along the front surface of the main cabinet, wherein the display assembly further comprises:
  - a second mechanical connector configured to interface with the first mechanical connector to releasably couple the display assembly to the main cabinet; and
  - a second electrical connector configured to contact the first electrical connector when the display assembly is physically coupled to the main cabinet to electrically couple the display assembly to the main cabinet.

11. The gaming device of claim 10, further comprising a cabinet lock, wherein:

- when the cabinet lock is in an unlocked position, the first mechanical connector and the second mechanical connector at least partially detach the display assembly from the main cabinet; and

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when the cabinet lock is in a locked position, the first mechanical connector and the second mechanical connector couple to secure the display assembly and the main cabinet.

12. The gaming device of claim 9, further comprising a light pipe disposed underneath the glass cover sheet and configured to diffuse light.

13. The gaming device of claim 10, wherein the display panel defines:

a first planar display region; and  
a second planar display region offset from the first planar display region by an offset angle.

14. The gaming device of claim 13, wherein:

the offset angle is a first offset angle;  
the display assembly further comprises a third planar display region offset from the first planar display region by a second offset angle; and

the first planar display region is substantially perpendicular with respect to a mounting surface of the main cabinet.

15. The gaming device of claim 9, wherein:

the display output corresponds to operations of a game associated with the gaming device; and

the edge lighting output is visually distinct from the display output.

16. The gaming device of claim 15, wherein the edge lighting output comprises an animation.

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17. A display assembly configured to be coupled with a main cabinet of a gaming device, the display assembly comprising:

a display panel defining a perimeter region and configured to provide edge lighting to the perimeter region;

a cover sheet extending over the display panel and defining a raised perimeter region disposed above the perimeter region of the display panel, the raised perimeter region defining a raised surface protruding from a portion of an outer surface of the cover sheet; and

a light pipe disposed underneath the raised perimeter region, the light pipe configured to diffuse the edge lighting from the display panel and towards the raised perimeter region.

18. The display assembly of claim 17, wherein the display panel defines:

a first planar display region configured to provide a first graphical output; and

a second planar display region configured to provide a second graphical output, the second planar display region offset from the first planar display region by an offset angle.

19. The display assembly of claim 18, wherein the first graphical output and the second graphical output are separately controllable with respect to the edge lighting.

20. The display assembly of claim 18, wherein the edge lighting is visually distinct from the first graphical output and the second graphical output.

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